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RECALL IN RELATION TO RETENTION.

GARRY C. MYERS, PH.D.
Brooklyn Training School for Teachers.

Experimental studies of the value of recall in the learning process have been made by E. E. Abbott[1], Katzaroff[2], Witasek[3], and Knors[4]. These writers have been interested chiefly in the value of recall in the process of study, of learning a lesson, for example. Perhaps it is of equal importance to know what is the value of recall in relation to retention, i. e., after the lesson is learned what value has recall in retaining it? To find an answer to this question is the purpose of the following study.

Three hundred and thirty-two boys and girls of normal school, academy, and seventh and eighth grades were tested by the writer. As stimuli the following ten words were pronounced with regular tempo,—shovel, tongue, spool, kettle, feather, clock, pickle, dirt, grocer, onion. The subjects were made to believe it was a real spelling test. Each word was pronounced only once, and the records of those who did not get the words as pronounced were discarded. For the recalls the subjects were provided with a sheet of paper and, after labeling it, were surprised by the request to write as many of

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[1]*On the Analysis of Recall in the Learning Process.* Psychol. Rev., Monograph Supplement, XI, No. 1 (1909).

[2]*Le rôle de la récitation comme facteur de la mémorisation.* Arch. de Psychol., VII, pp. 225-253 (1908).

[3]*Uber Lesen und Rezitieren u. s. w.* Zeitsch. f. Psychol., XLIV, pp. 161-185 (1907).

[4]*Experimentelle Untersuchungen über den Lernenprozess.* Archiv. f. d. gesamte Psychol., XVII, pp. 297-361 (1910).

the words they had previously spelled as they could remember. (No directions as to order were given). Three minutes were given for all the recalls. The whole experiment was conducted closely after the method used in my study of *Incidental Memory*[5]. This method was successful in throwing the subjects off their guard, making them believe that each recall was the last one. Therefore there was little danger of promiscuous recalls. After each recall no opportunity was given to check up results, and during the intervals before recalls (excepting the recalls after three weeks) all subjects were kept busy with their regular work. Two groups from each grade were tested for the purpose of comparison. Four series of tests were made on the following groups:

Juniata Academy.

1. Recall ofter thirty minutes.
2. Immediate recall and recall after thirty minutes.
3. Immediate recall, recall after five minutes and recall after thirty minutes.

Tyrone, Seventh and Eighth Grades.

1. Recall after one hour.
2. Immediate recall and recall after one hour.

Huntingdon, Seventh and Eighth Grades.

1. Immediate recall and recall after three weeks.
2. Immediate recall, recall after one hour and recall after three weeks.

Normal School.

1. Immediate recall and recall after three weeks.
2. Immediate recall, recall after five minutes and recall after three weeks.

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[5]Archives of Psychol., No. 26, Feb., 1913.

TABLE I

JUNIATA ACADEMY

	MALES										FEMALES									M. & F.		
	Immed.			After 5 Min.			After 30 Min.			Immed.			After 5 Min.			After 30 Min.			After 30 Min.		
Group No.	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Subj. No. Words	(11)	(8)		(11)			(11)	(8)	(17)	(12)	(8)		(12)			(12)	(8)	(17)	(23)	(16)	(34)
10	..	..	..	..	..	..	3	..	..	..	..	..	1	..	..	6	..	..	9	..	..
9	1	..	..	1	..	..	..	..	..	..	..	..	2	..	..	2	1	..	2	1	..
8	..	1	..	1	..	..	..	2	1	3	..	..	3	..	..	2	3	..	2	5	1
7	3	1	..	3	..	..	2	2	2	3	1	..	4	..	..	1	1	6	3	3	8
6	3	2	..	3	..	..	6	1	5	1	2	..	1	..	..	1	2	4	7	3	9
5	3	3	..	2	..	..	..	1	3	5	3	..	1	..	..	..	1	5	..	2	8
4	..	..	..	..	..	..	..	2	5	..	2	..	..	..	..	..	..	2	..	2	7
3	1	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
2	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Per Cent.	60	56.2		62.7			72.7	61.2	52.3	63.3	52.5		75.8			89.2	71.2	58.2	81.3	66.2	55.3

TABLE II

TYRONE. 7TH AND 8TH GRADES

	MALES				FEMALES				M. & F.			
	Immed.		After 1 Hour		Immed.		After 1 Hour		Immed.		After 1 Hour	
Group No.	1	2	1	2	1	2	1	2	1	2	1	2
Subjects	(24)		(24)	(28)	(41)		(41)	(30)	(65)		(65)	(58)
No. Words												
10	..	..	..	..	..	..	2	..	..	..	2	..
9	..	..	1	..	1	..	11	..	1	..	12	..
8	2	..	5	..	5	..	11	..	7	..	19	..
7	8	..	6	2	7	..	8	2	15	..	14	4
6	8	..	2	3	19	..	6	2	27	..	8	5
5	4	..	6	4	5	..	3	10	9	..	9	14
4	2	..	2	7	4	..	..	7	6	..	2	14
3	..	..	2	9	..	..	..	8	..	..	2	17
2	..	..	..	3	..	..	..	1	..	..	..	4
1	..	..	..	..	..	..	..	..	..	..	..	..
0	..	..	..	..	..	..	..	..	..	..	..	..
Per Cent.	61.7		61.2	40.4	61.7		76.6	43.3	61.7		70.3	41.9
By 7th Gr.	58.3		52.5	37.5	59.4		69.4	41.2	58.9		62.2	39.6
By 8th Gr.	65		70	42.5	73.2		81.2	45.7	70.5		77.3	44.0

Tables I, II, III, and IV show the comparative records for the recalls after the various intervals of time. The vertical column of figures to the left in each table indicates the number of words recalled. The figures in parenthesis near the top of the tables give the number of subjects. Above them are the group numbers. The bottom horizontal row shows the total per cent. of recall, i. e., of the whole number of stimulus words. The other figures in vertical columns indicate the number of subjects who recalled each word. In Table I for example, we read under "Males", Group 1, of "Immediate Recall", "1 recalled 9 words; 3, 7 words; 3, 6 words; 3, 5 words; and 1, 3 words." The position of the group numbers and columns indicate that group number one recalled the words immediately after the stimuli were given, after five minutes and after thirty minutes; group number two, immediately and after thirty minutes, group number three, only after thirty minutes.

The results for final recall are best with two intervening recalls, and for only one intervening recall much better than for none. The gain by the five minute over the immediate recall is noticeably greater in its effect on the final recall, than the gain of immediate recall over no intervening recall. This is especially true for girls, whose figures give 89, 71, and 58 per cent. for final recall after two, one and no intervening recalls.

TABLE III

HUNTINGDON. 7TH AND 8TH GRADES.

	MALES						FEMALES						M. & F.					
	Immed.		After 1 Hour		After 3 Weeks		Immed.		After 1 Hour		After 3 Weeks		Immed.		After 1 Hour		After 3 Week[s]	
Group No.	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Subj.	(23)	(16)*	(23)		(20)	(25)	(32)	(11)*	(32)		(32)	(27)	(55)	(27)	(55)		(52)	(52)
No. Words																		
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	1	..	..	..	..	..	1	..	..	..	..	..	2	..	..	..
8	1	..	..	..	1	..	1	..	2	..	..	..	2	..	2	..	1	..
7	2	..	3	..	..	..	3	2	5	..	3	..	5	2	8	..	3	..
6	2	6	7	..	3	2	10	1	10	..	9	7	12	7	17	..	12	9
5	9	5	6	..	4	5	5	4	3	..	8	6	14	9	9	..	12	11
4	9	4	4	..	5	8	10	3	7	..	3	4	19	7	11	..	8	12
3	..	1	2	..	4	6	2	1	3	..	5	7	2	2	5	..	9	13
2	..	..	..	..	2	3	1	..	1	..	2	2	1	..	1	..	4	5
1	..	..	..	..	1	..	..	..	..	..	1	1	..	..	..	..	2	1
0	..	..	..	..	..	1	..	..	..	..	1	..	..	..	..	..	1	1
Per Cent.	50	50	53.9		41.5	37.2	50.6	50	54.4		45.9	42.2	50.4	50	54.2		44.4	39.8

*Record for 7th grade lost.

TABLE IV.

C. V. S. N. S.

	FEMALES					
	Immed.		After 30 Minutes		After 3 Weeks	
Group No.....	1	2	1	2	1	2
Subjects.....	(16)	(16)	(16)		(16)	(16)
No. Words						
10	..	..	..	..	1	..
9	1	..	1	..	..	..
8	2	1	2	..	..	1
7	1	7	3	..	1	1
6	7	4	8	..	3	6
5	4	3	1	..	4	2
4	1	1	1	..	4	4
3	..	..	..	..	1	1
2	..	..	..	..	2	1
1	..	..	..	..	..	..
0	..	..	..	..	..	..
Per Cent.....	61.2	62.5	64.4		48.7	51.2

The girls show a higher total gain as a result of the intervening recalls. For the boys the corresponding figures are 73, 61, and 52. The tables of frequency show very clearly the effect of the recalls upon retention. (See "After 30 minutes" for males and females combined.) The modes for each final recall are at 10, 8, and 6 respectively.

Table II gives the results for final recall after one hour, with and without immediate recalls, for the seventh and eighth grades combined. Here the total percentages show a strong gain in efficiency after one hour, as a result of immediate recall. As found above the gain for girls is greater than that for the boys, and their general efficiency is better. This is also obvious in the tables of frequency. The last two horizontal rows of figures at the bottom of the table give the total percentages for each of the seventh and eighth grades. The same tendency is shown for the respective grades, but the efficiency of the eighth grade is constantly better than for the seventh grade.

The effect of intervening recalls upon retention when the final recall was taken after three weeks, and the intervening recalls were taken immediately and after one hour respectively, is much less obvious than in tests where the final recalls were made after one hour and after one-half hour. (Compare Tables I and II with III.) While the total record for the two

groups, each of 52 girls and boys (Table III), shows a gain of only about 4½ per cent., the frequency tables make the difference more evident.

The two groups of normal school students (Table IV) with immediate recall and recall after 30 minutes, show, after three weeks no gain as a result of a 30 minute recall added to an immediate recall, but rather indicate a slight loss. The writer hazards no explanation, but simply suggests that since these are the only groups tested in which the group to be tested had a chance to communicate with the group already tested (the opportunity here possible during exchange of classes), some duplicate answers might have been given by the second group. Of course this difficulty was not at all present with the other groups. Assuming that all conditions were perfect, it is probable that with this group as well as with the Huntingdon group, the disturbing element of having a second recall unexpectedly, thereby causing a state of confusion, may contribute less to a recall after three weeks than it hinders, for here complexity would confuse after the second recall rather than clarify.

TABLE V

HUNTINGDON AND TYRONE

	Immed. Recall			After 1 Hour			After 3 Weeks		
	Males (63)	Females (84)	M. & F. (147)	Males (75)	Females (103)	M. & F. (178)	Males (45)	Females (59)	M. & F. (104)
10	..	..	..	..	2	2	..	..	..
9	..	1	1	2	12	14	..	..	..
8	3	6	9	5	13	18	1	..	1
7	10	12	22	11	15	26	..	3	3
6	16	30	46	12	18	30	5	16	21
5	18	14	32	16	16	32	9	14	23
4	15	17	32	13	14	27	13	7	20
3	1	3	4	13	11	24	10	12	22
2	..	1	1	3	2	5	5	4	9
1	..	..	..	..	..	..	1	2	3
0	..	..	..	..	..	..	1	1	2
Per Cent.	54.4	56	55.3	51.2	60.0	56.3	39.1	44.2	42.0
A. D. in words	.98	1.04	10.5	1.40	1.65	1.64	1.11	1.67	1.37

Table V gives the combined records of those groups of the two schools to which were given the same time intervals for recall.[6] All those recorded "After one hour" had "Imme-

[6]The larger number of subjects for recall after one hour is due to the fact that the records for immediate recall by the seventh grade were lost.

diate Recall", and all "After three weeks" had recall "After one hour." The total percentages show a slight loss for boys and a gain for girls after one hour. The decided loss shown after three weeks is greater for the boys than for the girls. Between records for "One hour" and "Three weeks" the opposite is true. The girls are noticeably superior to the boys and their mode is one degree higher, for each period of time. For immediate recall and recall after one hour, the mode for the boys is at 5, for the girls at 6. After three weeks it is at 4 and 6 respectively. The average deviation from the mode is consistently greater for the girls than for the boys.

A study was made of a comparison of the individual records for first, second and third recalls by 120 boys and girls of the seventh and eighth grades.

First Recall minus Second Recall.

(47 boys)	(73 girls)
21 plus cases	45 plus cases
14 minus cases	12 minus cases
12 like cases	16 like cases
C.E.+.2 words	C.E.+.97 words

This means e. g. that for the boys 21 gave more words in the second recall (after one hour) than in the first (immediate recall), 14 gave less and 12 gave the same number, with an average of two-tenths of a word more in the second than in the first recall. The superiority of the girls is obvious.

Second Recall minus Third Recall.

(20 boys)	(32 girls)
3 plus cases	3 plus cases
11 minus cases	17 minus cases
6 like cases	12 like cases
C.E.—.95 words	C.E.—.78 words

In 76 per cent. of the (120) cases the words which were given in the second recall appeared also in the first recall—for boys 81, for girls 73.8 per cent., and in a total of 75.7 per cent. of

the cases the words given in the third recall were present in the second recall—boys 85.3, and girls 70.5 per cent.

On the other hand, of the 47 boys, 18, or 38 per cent. had in the second recall only words which were included in the first recall. Eighteen added 1 correct word, 6 added 2 words, 4 added 3 words, 1 added 5 words. For example 18 gave 1 correct word which was not included in the first recall. Of 73 girls, 13, or 18 per cent. had in the second recall only words which were included in the first recall. Eighteen added 1 correct word, 25 added 2 words, 13 added 3 words, 4 added 4 words.

Of 20 boys, 12 had in the third recall only words which were included in the second recall. Five added 1 correct word, 2 added 2 words, 1 added 3 words. Of 32 girls, 7 had in the third recall only words which were included in the second recall. Thirteen added 1 correct word, 6 added 6 words, 5 added 3 words, 1 added 4 words.

While there is a high degree of consistency in the successive recalls it is remarkable that so many words appear in subsequent recalls which were not in the preceding recalls. Perhaps such words were just on the threshold of consciousness during the preceding recalls or were blocked by interfering associations. It is obvious that the girls do not carry over from the first to the second and third recalls as many words as the boys, but are more likely to substitute words not given in the first recall. It would seem from this that the boys are more consistent than the girls. A Pearson coefficient of correlation between the first and second recalls was computed for the 73 girls with a result of +.71. This means that the individuals who answered well in the first recall could be expected to do well in the second recall and those who did poorly in the first recall, poorly in the second recall.

Conclusion.

There is a decided gain in final recall as a result of intervening recalls without re-presentation of the stimuli, and this gain is greater for a 5 minute recall than for an immediate recall. The effect of intervening recall is very much greater when the final recall is taken after 30 minutes or one hour

than when taken at the end of three weeks. The gain by the girls is greater than that by the boys, and their general efficiency is higher.

An Added Experiment.

The following experiment illustrates how the relation of recall to retention may be studied in a very practical way. Two prose readings, one of 464 words, the other of 1242 words, were learned for the first time by a lady student* of my class of College Seniors in Psychology, and recited before the College Literary Society. The shorter one was recited two weeks before the longer one; each was recited successfully and was prepared within a few days before recitation. Having learned that this student had recited these selections, the writer asked her one week after the last one was recited to recall the last selection. She recalled it perfectly. Then she recalled it at the end of each of seven successive weeks. She made no other recalls of it in the meanwhile, nor did she see the original. At the end of the seven weeks she was still able to recall it *verbatim*. Seven weeks after the learning of the first selection it was recalled (no intervening recalls). The subject in the meantime did not know this selection would be called for. Only 200 of the 464 words were recalled. In this reading the first and last parts were remembered best.

Thus we find that the longer selection, recalled on seven successive weeks after it was learned, was remembered perfectly while more than half the shorter selection, which had no intervening recalls was forgotten.

Pedagogical Significance.

Much has been written about the value of the proper presentation of the stimuli (lesson) and about the value of the recitation as a means to aid the child properly to interpret and learn the stimuli. There is a third purpose in the process of education which is too much ignored, namely, to help the child retain what he has learned.

Simple recall of stimuli wholly or partially learned aids in their retention. Teachers and pupils would profit greatly by

*Miss Margaret Griffith.

frequent recalls of things they have learned, while the material is fresh in mind, rather than have long and arduous reviews that require an extensive re-study of the material once learned. There should be more frequent but shorter reviews, reviews that demand little or no extra study, but a recall of materials already learned. It is often the custom in our secondary schools and colleges to give examinations after long intervals of one, two, three or more months. The students often go through cruel and torturous processes of cramming and after the examination is over are happy to forget about what they learned. A five or eight minute test given unannounced, demanding recall of the things recently learned, as well as those more remotely learned, with a final survey-test of the whole field studied, will aid the student to master a subject with little or no conscious effort at re-study. In fact this would be merely an application of the laws of apperception in the process of learning.

Some educators have courted wide applause by denouncing examinations as foolish, impractical, uneffective and barbarous. Examinations that put the emphasis on measuring what a pupil knows, that induce children to worry and become nervous, examinations that put a premium on cramming, admit of criticism. Not the principle of examination but its method is at fault. The true purpose of the examination is to compel reorganization and recall of things already learned. From the "measuring" viewpoint the examination naturally comes at long intervals for convenience to the examiner and consequently the teacher feels that the examination must be long and comprehensive. The field covered is covered for all time. From the viewpoint of recall, the field is never covered, the student always feels responsible for all he has learned. He does not have to go through a cramming process once every month or half year. He must always be ready; examinations are brief experiences to which he habituates himself.

Life demands constant recall of a part or of all of one's experience, at irregular intervals and seldom with much warning. Life demands, moreover, quick recall of one's best experiences immediately to solve situations that come unannounced.

The discipline that comes from definite recall on short notice develops habits of quickly marshalling one's mental forces and necessarily makes one constantly mindful of the fact that what one learns will have to be learned not merely for one occasion, not merely for one recitation, or for one examination but for times whose number will depend upon the variety of experiences and the length of one's life.

Every possible incentive for the pupil to recall in his study and recitation should be afforded by the teacher. In the grades each study should be so presented as to compel the student to recall again and again what he has learned not merely of any one particular study but in so far as possible what he has learned of every other study.

Ideal methods may be at the hand of the teacher but it is a fact too evident that the teacher is generally handicapped by poor text books and most teachers follow the text almost entirely. Surely the value of recall has not been duly recognized by writers of text books.

Some recent spellers have been carefully written observing the value of recall as applied to the spelling per se. Perhaps no speller has been written wholly applying the value of recall in relation to other studies. The speller should be so constructed and the curriculum so outlined that each spelling lesson the pupil studies will deal with words used at the same time in his English, History, Geography, etc. Thereby the use of words in one subject will necessarily recall the words used in other subjects. In short, the ideal course of text books for any given school would be such that the things learned in each subject will have to be recalled in as great measure as possible in the study of any other subject.

Finally, the curriculum should be so arranged that not merely while the student deals with books will he be compelled to recall what he has previously learned, but also later in life. However, life does not tend to fit the curriculum. The curriculum will have to fit life. No incentive to recall can be so great as the natural life incentives. Let the curriculum be such that life will constantly make the student recall what he has learned in school and that the school will compel the student constantly to recall life's experiences.

ELEMENTS OF ARITHMETICAL ABILITY.

G. R. DAVIES,
University of North Dakota.

SUMMARY.

Classes in arithmetic were given certain tests more or less closely connected with the routine work. The tests included computation, reasoning, visualizing, memory span, and mental work. It was found that, while there was a wide diversity in the individual capacities of the pupils, certain tests gave a close approximation to the arithmetical efficiency as measured by the term grade. Thus, though there was only a very slight correlation between computation and reasoning, yet an average between the computation and the reasoning tests correlated very strikingly with the term grade. This fact points to a simple means of determining a pupil's capacity for arithmetical work. Ability to visualize was also found to correlate somewhat closely with arithmetical power.

PURPOSE.

The principal purpose of the series of tests about to be described was to discover if there were any simple ways of testing general efficiency in arithmetic, or special ability in any particular department of the work. It was thought, *a priori,* for example, that memory span and visualizing might have something to do with ability in mental work. The question as to whether simple tests in reasoning can be depended upon to give any indication of real efficiency was to be a part of the investigation. It was also hoped that the experiments would serve to illustrate individual variations.

PROCEDURE.

To measure ability in computation simple tests with combinations of digits were used. These were practically identical with the Courtis tests, though at the time they were first employed the latter had not been made public. In testing addition mimeographed sheets were prepared on which were arranged all the combinations of the digits and zero by twos, including each combination in the reverse order. These sheets

were distributed to the class, and the work of writing the sums was begun at a given signal. At the end of exactly one minute the signal was given for stopping. The papers were then corrected and the score of each pupil was recorded, the score being simply the number of sums written correctly. Before giving the test the pupils were made thoroughly familiar with its nature, not only by explanation but also by practice; in fact a similar exercise was commonly used as a form of drill. The test in multiplication was given in the same way, using the multiplication combinations.

The test in mental arithmetic consisted of the fundamental operations and fractions. In the former several series were given, such as $9 \div 3$, $+ 2$, $\times 3$, -1, $\div 7$, and so on. Multiplications and divisions of the following sort were included: 1482×3 and $2435 \div 5$, but the numbers were not extended beyond four figures so as not to exceed the memory span of the weakest pupils. At a signal the class wrote their results on sheets of paper, which at the close of the exercise were collected and graded.

The test for memory span was given in much the same way as is described in Whipple's "*Manual of Mental and Physical Tests.*" The presentation was auditory—visual—articulatory. The lists of the digits to be presented were carefully prepared beforehand so as to avoid any combinations that would help the memory. The series were written, one set at a time, on the blackboard, under the cover of a screen; on removing the screen the class read the list at the rate of one per second. The first and lowest series consisted of four digits, and the last of ten; there were two series of four, two of five, and so on. The scoring was done substantially as suggested in Whipple's *Manual.* Preliminary tests in this as in other cases were given in order to accustom the pupils to the procedure.

The test used for visualizing was as follows. A set of crossing vertical and horizontal lines, resembling enlarged cross-section paper, was drawn upon the board, and the class was told that this was to represent a map of rural section lines; that is, the roads bounding the square miles. A point was chosen at the center of the map which was to be taken as the

starting point for an imaginary journey, to be described as so many miles north, so many east, and so on, describing a course zigzagging about the central starting point. When the idea was thoroughly understood, the map was erased from the board, and the pupils were asked to picture the section lines in their minds. Twelve descriptions of imaginary journeys were given, increasing in complexity. In order to obviate the difficulty that some pupils have in thinking the points of the compass quickly, these were indicated by a motion of the hand. It was assumed that ability to follow the descriptions of the journeys would depend upon visualization of the map, and that this was the case was evidenced by the fact that the results correlated fairly closely with the results of other visualizing tests of quite a different type. Of course it is true that pupils might eventually find a way of computing the points in the supposed journey without much visualizing, but the test was not used enough to make this possibility at all probable.

In the experiments with the second class another and probably more familiar test in visualizing was used. A cubical block, three inches on the edge, painted a certain color was presented to the class. It was then removed, and the pupils were asked to imagine that it was cut into smaller blocks each a cubic inch in size. Each pupil then recorded his mental picture of the smaller blocks, stating on how many sides each block was painted. The same procedure was repeated with other blocks of varying sizes. The objection to this test is that it is so soon learned by rote that it cannot be experimented with, hence the pupils cannot be made thoroughly familiar with it. As a result some did not understand what was expected of them, and the test was consequently unsatisfactory. Other methods, as letters and symbols arranged in squares, were experimented with, but were found to be impracticable for class use, and the results were not recorded.

The reasoning test consisted of problems involving usually two or three steps of reasoning, and sometimes a "catch." In no case was the computation at all difficult. The material was taken from operations on which no especial drill had been given, so that the problems had to be thought out. As samples of the questions the following may be given:—

If ⅔ of ¾ of a number is 6, what is the number?

Of four, what part is five?

A boy measuring the length of a house found it to be 11½ yards long, but he later found that his yardstick was three inches short. How long was the house?

Square each of the following: 1, 1½, 2, 2½, 3, 3½, 4, 4½, 5. From an inspection of your results state a short method of finding the squares of the numbers ending with one-half. Apply this short method to finding the square of 5½ and 6½.

If a horse weighs 1200 lbs. when standing on three legs, how much will he weigh when standing on four?

A map is drawn on the scale of ¾ in. to the mile. A second map is drawn on such a scale that four miles on the first map equals six miles on the second map. What is the scale of the second map?

The test was given in the form of an examination, with a time limit sufficient for nearly all the class to finish. Full statements of the methods of arriving at conclusions were required.

In addition to these tests the term grades were used in the correlations. These grades were based on daily work and two examinations, the former counting as two-thirds of the total. The course included a complete review of arithmetic, covering all topics ordinarily taught in the common school. While the problems used involved arithmetical reasoning of some complexity, they were not in general of the type given in the reasoning tests; in fact a point was made to use problems in the daily work that were practical and that did not involve anything of a more "catchy" nature than is found in the ordinary uses of arithmetic. For these reasons the final term grade should be a fair measure of efficiency in arithmetic.

The following tables give the results of the tests; in the first table appears the most extended experimentation, while in the second table are recorded the results of a less complete supplementary series. From this data the correlations that follow were computed. A few of the same tests were given to other classes as will be mentioned later, but in these cases it has not been deemed necessary to give the original data. The classes concerned in the following tables consisted of eighth grade graduates, then enrolled in the first year of the elementary course of the State Normal School at Valley City, N. D. The experimenting was done by the writer with the assistance of two advanced students. Since each of these persons was thoroughly familiar with the pupils, and had given the tests

together on more than one occasion before taking the recorded results, substantial accuracy was insured. In the tables the results appear in part in the form of per cents of the class average, as this was the usual method of recording such grades (See JOURNAL OF EDUCATIONAL PSYCHOLOGY, April, 1912, pp. 222-223). In transferring to this form there would be no more occasion for error than in ordinary copying, since the results were read from the slide rule and were all carefully checked.

In the supplementary set of tests a class of equal grade was experimented with, and the work was done in the same way with the exception of the visualizing test as already mentioned. In order to save time the papers in this series were ranked, and the rank alone was recorded. In regard to the correlations it may be said that the first three or four were computed by the Pearson method of rank differences (Whipple, p. 32 ff.), but the greater portion of the work was done by the Spearman "Foot-Rule" method (Whipple, p. 34 ff.), the "R" values being converted into the Pearson "r" values by reference to a table of equivalents.

CONCLUSIONS.

Ability in one of the fundamental operations has a high correlation with ability in another. The second test in addition correlated with the test in multiplication gives $r = 0.72 \pm 0.06$. The same correlation computed from columns a and b in the second table gives $r = 0.75 \pm 0.06$, and in still a third case, of which the data is not given, $r = 0.85 \pm 0.04$. Moreover, practice does not greatly change the relative standings of pupils. The two tests in addition, given two months apart, during which time an average gain of about eight per cent had been made, show the high correlation of $r = 0.80 \pm 0.05$. Ability in written computation, as measured for each pupil by his average in addition and multiplication (average of columns B and C), when correlated with the results of the mental test, gives $r = 0.52 \pm 0.09$; in the case of the second class a parallel correlation (columns c and f) gives the insignificant result, $r = 0.22 \pm 0.12$. Evidently facility in mental arithmetic does not necessarily follow from facility in written work, though some connection obtains. The relation

RESULTS IN PRINCIPAL SERIES OF TESTS

PUPIL		(A) ADDI. Av., 62.5 A. D., 19%	(B) ADDI. Av., 67.3 A. D. 14%	(C) MUL. Av., 47.3 A. D., 16%	(D) MENTAL Av., 76.7% A. D., 13%	(E) MEM. SPAN Av., 7.7 A. D., 8.2%	(F) VISUAL Av., 42% A. D., 46%	(G) REASON Av., 73.2% A. D.. 21%	(H) TERM Av., 78% A. D., 12%
1.	J. A....	112%*	101%*	85%*	130%*	7**	71%*	132%*	122%*
2.	E. A....	122	126	133	111	9.5	95	101	109
3.	L. A....	120	126	119	130	8.5	71	125	113
4.	L. B....	—	100	70	—	7.5	119	93	77
5.	F. B....	130	126	125	115	8	166	132	124.5
6.	A. B...	—	80	104	91	7	119	104	104
7.	J. B....	94	100	106	90	7	—	57	69
8.	W. B...	107	97	119	110	9	166	60	94
9.	R. B...	67	70	70	100	8	119	123	108
10.	I. C....	120	89	100	85	6	119	112	91
11.	C. C....	—	79	74	78	—	—	86	73
12.	L. C...	98	104	106	130	8	214	125	126
13.	B. E...	144	141	136	116	7	24	18	96
14.	M. E...	78	—	—	—	—	166	125	96
15.	B. F...	94	103	106	103	7	47.5	98	88.5
16.	S. F....	117	107	108	100	7	166	137	122
17.	H. G....	70	77	95	98	8	24	126	96
18.	V. H...	104	104	95	94	7	119	109	97.5
19.	G. J...	—	—	—	—	—	47.5	75	94
20.	M. K...	122	125	106	52	7	0	82	78
21.	C. K...	101	100	91	91	7.5	47.5	89	68
22.	N. L...	117	94	119	100	7	24	83	99
23.	M. M..	138	120	106	117	8	71	137	124.5
24.	O. M...	64	70	61	98	8	24	97	92
25.	E. N...	106	100	125	91	9	214	91.5	110.5
26.	A. N...	82	79	72	98	8	95	86	97.5
27.	A. S...	94	88	85	78	8	119	108	101
28.	L. S....	48	82	95	86	7	71	101	100
29.	E. S...	—	120	127	125	8	—	78	112
30.	H. S...	93	86	87	87	9	47.5	75	97.5
31.	M. S...	96	107	97	98	8	142	122	117
32.	C. W...	62	97	83	104	7	95	115	102.5

*Per cent. of the average given above.
**Number of digits.

The averages in addition and multiplication mean the number of combinations of two figures added or multiplied in a minute. Two months of work intervened between the two tests in addition.

The averages in the mental, visualizing, and reasoning tests mean the percentage of questions answered correctly; that is, the grading was done in the usual way and the average grade for all pupils found.

which computation,—measured by the addition and multiplication tests as above,—bears to the term grade naturally varies with the character of the requirements in a given class. In the principal data a correlation of $r = 0.26 \pm 0.12$ is found. That this is somewhat lower than normal is indicated by the

RESULTS IN SUPPLEMENTARY SERIES OF TESTS—RANKINGS OF PUPILS

	PUPILS	(a) Addition	(b) Multiplication	(c) Average of A & B	(d) Reasoning	(e) Visualizing	(f) Mental Arith.	(g) Term Grade
1.	G. A.....	24	13	18	1	—	5	3.5
2.	G. B.....	21	21.5	22	11.5	15.5	22	22.5
3.	L. B.....	7.5	3	5	13	23.5	—	2
4.	E. B.....	3	1	2	10	2	5	3.5
5.	P. B.....	16	6.5	10	4	—	24.5	16.5
6.	R. C.....	28	27	28	6.5	15.5	26	12
7.	M. C.....	6	4	4	23	12	15	24.5
8.	H. C.....	14	24	19.5	28	—	27	29
9.	A. D.....	10	19	13	2	5	5	6.5
10.	H. E.....	5	8	6	26	19.5	23	26
11.	E. E.....	2	5	3	11.5	19.5	8	6.5
12.	L. F.....	9	6.5	7	3	12	11.5	16.5
13.	T. G.....	7.5	10	8	18	9.5	11.5	22.5
14.	E. G.....	25	13	19.5	17	23.5	18.5	20
15.	A. J.....	17	15	15	14	7.5	11.5	10
16.	E. J.....	4	—	—	—	15.5	—	28
17.	I. K.....	13	13	11.5	6.5	19.5	18.5	13
18.	A. M.....	1	2	1	27	7.5	18.5	1
19.	I. M.....	26	19	23	15	12	11.5	14.5
20.	E. P.....	18	21.5	21	16	9.5	1	18.5
21.	W. P.....	19	16.5	16	8.5	2	18.5	10
22.	D. R.....	15	11	11.5	8.5	2	2.5	10
23.	A. S.....	29	25	27	20	23.5	24.5	6.5
24.	E. S.....	22	28	25.5	22	23.5	18.5	24.5
25.	A. T.....	27	23	25.5	25	19.5	18.5	27
26.	M. T.....	20	16.5	17	19	5	11.5	14.5
27.	A. T.....	12	9	9	5	—	11.5	6.5
28.	D. T.....	11	19	14	21	15.5	7	18.5
29.	L. V.....	23	26	24	24	5	2.5	21

Column (c) is obtained by averaging the scores in the two preceding tests, and ranking pupils in accordance with this average.

As in the preceding table, dashes indicate failure to take test. They necessitate a certain degree of re-ranking in making some of the correlations, since any pupil failing to take one or both of the tests in question must be omitted.

fact that in the supplementary tests the value found is $r = 0.44 \pm 0.10$. In another case not here recorded, in which the reasoning and informational elements in the course were lower than usual, the correlation was high, namely, $r = 0.74 \pm 0.07$. In still another case,—a class studying methods of teaching as well as mathematical operations,—the correlation was the lowest; namely, $r = 0.22 \pm 0.12$.

Visualizing and memory span were tests which it was hoped might shed some light on the more usual arithmetical abilities. To some extent the results were disappointing. As to their relation to each other, these two tests show only a small cor-

relation, $r = 0.24 \pm 0.12$. In the case of another class of which the records are not here given, the correlation was negligible, being under 0.10. It might be expected that visualizing and memory span would show some definite relation to ability in mental work, but the following correlations show this to be small: memory span and mental tests, $r = 0.24 \pm 0.12$; visualizing and mental tests, $r = 0.07 \pm 0.13$; average of memory span and visualizing tests with mental test, $r = 0.25 \pm 0.12$. From this it appears that visualizing does not bear any important relation to mental work. However, this conclusion is contradicted somewhat decisively in the case of the second class, where visualizing as determined by another form of test already described, correlated with mental computation gives $r = 0.61 \pm 0.09$. Probably more importance can be attached to the results in the first case, since the testing was there done in a more satisfactory way, and it may be concluded that the visual type of memory is at least not the essential thing in mental computation, as it is not in the rote retention of the memory span. The latter shows a slight relation to the mental computation, and doubtless if somewhat larger numbers were used in the mental tests it would show a much higher correlation than the 0.24 just mentioned. This supposition was not tested, but it seems too obvious to need proof: if, for example a number of seven digits were given to a pupil whose memory span was only five the mental computation would be impossible because the number could not be held in mind.

When visualizing is compared with the term grade or with reasoning a considerable degree of connection appears. In the former case $r = 0.50 \pm 0.09$, and in the latter case $r = 0.48 \pm 0.10$. The second set of tests lowers these figures to $r = 0.31 \pm 0.12$ and $r = 0.14 \pm 0.13$ respectively, but as already stated the visualizing test was somewhat unsatisfactory in this case. The decisive correlations obtained with the first class suggest that visualizing ability is worthy of an extended investigation in connection with arithmetic. Inspection of individual cases bears out this conclusion. Take for example the case of pupil number 20, M. K., in the first table. This pupil had previously made a very poor record in arithmetic, having taken the course twice and failed, and at this time by dint of much

practice in the mechanics of arithmetic she had succeeded in gaining only the rank of twenty-eighth in a class of thirty-two. In computation in the written form she was proficient, in reasoning and mental computation she was low, but in visualizing she failed absolutely. If visualizing has such a close connection with efficiency in arithmetic as would appear from this case, it should be made the object of special training early in the school career.

Undoubtedly the most interesting and valuable correlations would be those between computation and reasoning, and between these two and the term grade. The relation between computation and term grade has already been discussed. As regards computation and reasoning, it may be said by way of comparison that Mr. W. H. Winch has reported finding a high positive correlation between the two functions (JOURNAL OF EDUCATIONAL PSYCHOLOGY, May, 1911). The study at hand, however, does not show this. It is found that with the first class $r = -0.06 \pm 0.12$, while with the second class $r = 0.18 \pm 0.13$, computation being measured for each pupil by the average of his scores in addition and multiplication, as previously mentioned. The lack of decided correlation between computation and reasoning thus disclosed may be due to the fact that considerable practice had previously been given in computation, and marked improvement had been shown, particularly by several of the low grade pupils who had given extra time to this practice. As Mr. Winch shows, there is not a transfer of training from one function to the other, hence training in the one function would tend to obscure a correlation that might have existed at first.

The reasoning test gives a marked correlation with the term grade. The coefficient is $r = 0.60 \pm 0.08$, and in the case of the second class $r = 0.59 \pm 0.08$. Evidently a very simple test in reasoning such as that described has a higher value in grading the ability of the pupil than one would expect. This value comes out in a more striking way if an average is struck between computation and reasoning, and this average correlated with the term grade. The result is $r = 0.65 \pm 0.07$, and with the second class $r = 0.60 \pm 0.08$. Inspection of individual cases shows that this correlation has a greater importance

than even the decisive coefficients indicate. In practically every case where there is a striking difference between the computation-reasoning average and the term grade, the pupil was found to be exceptionally industrious if the term grade was the higher, or lazy if it was lower. There were one or two exceptional cases, as that of number 23 in the second table, who did not do justice to himself in the tests because he had not a mastery of the English language and consequently did not fully grasp the directions. It appears then that computation and reasoning tests would give the teacher an approximate measure of the ability of the pupil, while the term grade divided by the average of the two tests would serve comparatively as a measure of a pupil's industry.

Finally, regarding the individuality of the pupils, the tests show conclusively the very varying degrees of development of the several abilities. After all, to say that a pupil is good or poor in arithmetic has no very specific meaning. A pupil who passes as good may be poor in computation, or in reasoning, or in mental work. As suggested in the individual case previously discussed, perhaps even so obscure an element as visualizing may be so lacking as to negative otherwise good ability. The problem for the teacher is to discover the weak point in the individual pupil, and if possible to supply means for remedying the deficiency.

CORRELATION OF EXCELLENCE IN DIFFERENT SCHOOL SUBJECTS BASED ON A STUDY OF SCHOOL GRADES.[1]

L. E. FRAILEY AND C. M. CRAIN,

University of Illinois.

The material for the problems which are to be herein presented was obtained at the Urbana High School, through the courtesy of the principal, Mr. M. L. Flaningam. Our purpose was to find, if possible, the correlation which might exist between (1) the standing of a pupil in one subject and his standing in other subjects, (2) the standing of a pupil during one year and his standing in succeeding years, (3) the standing of the average male student and the standing of the average female student, and (4) the variability of the male student and the variability of the female student in the limits of excellence.

In order to make our investigations as constant as possible it was necessary that we should select from the many students a certain group which had passed through the same conditions in respect to time of studying the subjects investigated, years of schooling, instructors, etc. After a great deal of necessary labor, examining the records of the pupils for the past six years, and selecting those pupils whose study experiences had apparently been identical in all respects, we were able to secure a group of 32 pupils who had undergone the same treatment and lived under the same conditions. We found (1) that this group of 32 students had all entered the Urbana High School in the fall of 1908 and graduated in the spring of 1912; (2) that they had studied together, under the same instructors, and at the same period, the subjects of algebra, civics, American history, geometry, Latin and English; (3) that they had studied in a like manner four successive years of English; and (4) that they were all normal students, mentally, physically,

[1]From the School of Education, University of Illinois.

and morally,—allowing, of course, for the normal variability. With this group, then, we believed that we could work upon a constant basis which should give trustworthy results.

(1) *Correlation Between Excellence in One Subject and Excellence in Another Subject.*

Our first problem was to determine the correlation between excellence in one subject and excellence in another. The first step was to rank the pupils selected according to their grades in one subject, algebra being the one selected. In order to have a unit of comparison which should allow for minor variations in grades we divided the 32 pupils into four groups of equal number; it being evident that if such a correlation existed, a pupil in group I (ranks 1 to 8) in algebra, should be in group I in civics, etc. If the correlation were perfect each group in each subject should contain the names of the same pupils. Each pupil was given a number which he retained in all of the determinations. The results of the groupings in the six subjects selected are as follows:

Algebra.

	Pupil No.	Sex.	Grade.	Rank.
Group I.	1.—	M	95	1
	2.—	M	95	1
	3.—	F	94	3
	4.—	F	93	4
	5.—	F	93	4
	6.—	F	93	4
	7.—	M	92	7
	8.—	M	92	7
Group II.	9.—	M	91	9
	10.—	F	90	10
	11.—	M	90	10
	12.—	F	90	10
	13.—	F	90	10
	14.—	M	89	14
	15.—	F	88	15
	16.—	F	87	16
Group III.	17.—	M	87	17
	18.—	M	87	17
	19.—	F	86	19
	20.—	F	84	20
	21.—	M	84	20
	22.—	M	81	22
	23.—	F	81	22
	24.—	F	80	24

Algebra (continued).

Group IV.

Pupil No.	Sex.	Grade.	Rank.
25.—	F	78	25
26.—	F	77	26
27.—	F	77	26
28.—	F	75	28
29.—	M	75	28
30.—	M	65	30
31.—	F	60	31
32.—	M	54	32

(Note: Number 32, or last in Algebra, is colored.)

Civics.

Group I.

Pupil No.	Sex.	Grade.	Rank.
8	M	97	1
10	F	97	1
12	F	95	3
3	F	95	4
4	F	93	5
5	F	93	6
16	F	93	5
1	M	92	8

Group II.

7	M	92	9
14	M	92	9
19	F	92	9
6	F	92	9
17	M	91	13
9	M	91	13
13	F	91	13
25	F	91	13

Group III.

21	M	91	13
11	M	90	18
31	F	90	18
15	F	90	18
20	F	89	21
23	F	89	21
24	F	88	23
30	M	86	24

Group IV.

2	M	85	25
22	M	85	25
29	M	85	25
28	F	85	25
26	F	81	29
27	F	77	30
18	M	75	31
32	M	75	31

(Note: Number 32 again last.)

American History.

	Pupil No.	Sex.	Grade.	Rank.
Group I.	1	M	93	1
	8	M	93	1
	4	F	92	3
	16	F	92	3
	17	M	91	5
	21	M	91	5
	9	M	91	5
	5	F	91	5
Group II.	3	F	90	9
	24	F	90	9
	12	F	90	9
	6	F	90	9
	10	F	90	9
	7	M	90	9
	14	M	90	9
	25	F	89	16
Group III.	22	M	89	16
	30	M	88	17
	15	F	88	17
	19	F	88	17
	11	M	85	20
	31	F	85	20
	28	F	83	22
	13	F	81	24
Group IV.	26	F	81	25
	2	M	80	26
	23	F	80	26
	20	F	77	28
	18	M	77	28
	29	M	76	30
	27	F	75	31
	32	M	75	31

Geometry.

	Pupil No.	Sex.	Grade.	Rank.
Group I.	8	M	92	1
	4	F	92	1
	24	F	91	3
	5	F	91	3
	20	F	91	3
	2	M	90	6
	3	F	90	6
	1	M	90	6
Group II.	12	F	90	6
	16	F	90	6
	11	M	90	6
	9	M	86	12
	14	M	84	13
	18	M	84	13
	29	M	84	13
	23	F	83	16

Geometry (continued).

	Pupil No.	Sex.	Grade.	Rank.
Group III.				
	17	M	83	16
	19	F	82	18
	6	F	81	19
	7	M	81	19
	13	F	80	21
	25	F	80	21
	26	F	79	23
	31	F	77	24
Group IV.				
	30	M	75	25
	22	M	73	26
	21	M	69	27
	10	F	69	27
	15	F	69	27
	27	F	66	30
	28	F	62	31
	32	M	43	32

Latin.

	Pupil No.	Sex.	Grade.	Rank.
Group I.				
	4	F	96	1
	10	F	96	1
	8	M	94	3
	16	F	93	4
	3	F	91	5
	5	F	91	5
	12	F	90	7
	1	M	88	8
Group II.				
	20	F	85	9
	13	F	85	9
	15	F	85	9
	23	F	85	9
	11	M	83	13
	2	M	83	13
	14	M	83	13
	31	F	82	16
Group III.				
	9	M	81	17
	18	M	80	18
	7	M	78	19
	19	F	78	19
	24	F	78	19
	29	M	78	19
	6	M	78	19
	17	M	75	24
Group IV.				
	25	F	70	25
	26	F	69	26
	22	M	69	26
	21	M	69	26
	27	F	67	29
	32	M	60	30
	28	F	53	31
	30	M	45	32

(Note: Number 32 for the first time is not last.)

English (4 *years*).

	Pupil No.	Sex.	Grade.	Rank.
Group I.				
	8	M	93	1
	10	F	92	2
	4	F	92	2
	16	F	92	2
	12	F	92	2
	14	M	90	6
	5	F	90	6
	3	F	90	6
Group II.				
	25	F	90	6
	15	F	90	6
	9	M	89	11
	1	M	88	12
	17	M	88	12
	19	F	88	12
	11	M	86	15
	7	M	85	16
Group III.				
	21	M	85	16
	6	F	84	18
	2	M	84	18
	20	F	83	18
	13	F	82	21
	18	M	82	21
	30	M	81	23
	23	F	80	24
Group IV.				
	24	F	80	24
	31	F	79	26
	26	F	79	26
	22	M	76	28
	28	F	74	29
	27	F	73	30
	32	M	73	30
	29	M	71	32

From the figures in the six subjects which have been tabulated above we were able to compile a composite table; showing the group for each pupil in each subject.

Pupil No.	Algebra.	Civics.	History.	Geometry.	Latin.	English.
1	I	I	I	I	I	II
2	I	IV	IV	I	II	III
3	I	I	II	I	I	I
4	I	I	I	I	I	I
5	I	I	I	I	I	I
6	I	II	II	III	III	III
7	I	II	II	III	III	II
8	I	I	I	I	I	I
9	II	II	I	II	III	II
10	II	I	II	IV	I	I
11	II	III	III	II	II	II
12	II	I	II	II	I	I
13	II	II	III	III	II	III
14	II	II	II	II	II	I
15	II	III	III	IV	II	II
16	II	I	I	II	I	I
17	III	II	I	III	III	II
18	III	IV	IV	II	III	III
19	III	II	III	III	III	II
20	III	III	II	I	II	III
21	III	III	I	IV	IV	III
22	III	IV	III	IV	IV	IV
23	III	III	IV	II	II	III
24	III	III	II	I	III	IV
25	IV	II	II	III	IV	II
26	IV	IV	IV	III	IV	IV
27	IV	IV	IV	IV	IV	IV
28	IV	IV	III	IV	IV	IV
29	IV	IV	IV	II	III	IV
30	IV	III	III	IV	IV	III
31	IV	III	III	III	II	IV
32	IV	IV	IV	IV	IV	IV

The above table throws much light upon the correlation of excellence in various subjects. Perfect group correlation is illustrated by numbers 4, 5, and 8 in Group I and numbers 27 and 32 in group IV. No perfect correlations are shown in groups II and III although pupils 11, 13, and 19 are in one or the other of the two groups in all subjects. Pupils 2, 10, 21, and 24 are the most inconsistent, appearing in both the first and last groups. Our data, therefore, suggest (1) that there is a correlation of excellence in the various subjects of study; (2) that the most perfect correlation exists among the brightest and among the most stupid children; (3) that the least perfect correlation exists among the pupils of medium ability; and (4) that it is rare for a pupil to represent both extremes of the excellence distribution. It is also interesting to note that number 1 ranked first in two subjects and number 8 first in three subjects. Number 32 who ranked last in all but one

subject is colored. Of the entire 32 pupils numbers 17, 18, 22, 30 and 32 were the most prominent in athletics; these numbers ranking in every case among the lower groups. Numbers 1 and 3 were the most active in other outside features of school life; these numbers ranking among the highest.

So far as this group is concerned we may conclude then that high ability is comparatively constant; that excellence in one activity means ability for similar excellence in another activity. And on the other hand it is also plain that, in this group, stupidity is comparatively constant; that lack of ability in one activity means similar lack of ability in other activities. Slight variations will occur more frequently among pupils of average capacity.

(2) *The Relative Standing of Pupils at Different Levels of Their School Life.*

Our second problem was to determine the correlation which might exist between the standing of a pupil during one year and his standing during succeeding years. For this we took the same group of 32 pupils; comparing their group standing in four successive years of English. The results of the groupings for the four years are as follows:

English 1.

Group I.	Pupil No.	Sex.	Grade.	Rank.
	8	M	95	1
	4	F	94	3
	16	F	93	3
	5	F	92	4
	3	F	92	4
	12	F	91	6
	10	F	90	7
	14	M	90	7
Group II.				
	25	F	89	9
	1	M	88	10
	9	M	87	11
	17	M	87	11
	11	M	86	13
	15	F	86	13
	6	F	85	15
	19	F	85	15

English 1 (continued).

	Pupil No.	Sex.	Grade.	Rank.
Group III.	24	F	84	17
	2	M	83	18
	20	F	82	19
	31	F	81	20
	18	M	80	21
	7	M	79	22
	13	F	78	23
	21	M	78	23
Group IV.	22	M	78	23
	30	M	78	23
	26	F	76	27
	29	M	75	28
	28	F	73	29
	27	F	73	29
	32	M	68	31
	23	F	67	32

English 2.

	Pupil No.	Sex.	Grade.	Rank.
Group I.	8	M	93	1
	4	F	91	2
	10	F	91	2
	15	F	91	2
	16	F	90	5
	5	F	90	5
	3	F	90	5
	12	F	90	5
Group II.	14	M	90	5
	25	F	90	5
	9	M	90	5
	17	M	90	5
	11	M	90	5
	2	M	90	5
	30	M	90	5
	19	F	89	16
Group III.	6	F	88	17
	7	M	88	17
	1	M	87	19
	20	F	87	19
	18	M	87	19
	23	F	87	19
	21	M	85	23
	26	F	85	23
Group IV.	32	M	85	23
	13	F	82	26
	24	F	80	27
	31	F	79	28
	29	M	79	28
	28	F	77	30
	22	M	75	31
	27	F	72	32

English 3.

	Pupil No.	Sex.	Grade.	Rank.
Group I.				
	8	M	94	1
	12	F	94	1
	10	F	93	3
	16	F	93	3
	4	F	92	5
	15	F	92	5
	9	M	91	7
	25	F	91	7
Group II.				
	3	F	90	9
	5	F	90	9
	13	F	90	9
	19	F	90	9
	1	M	89	13
	17	M	89	13
	14	M	88	15
	18	M	88	15
Group III.				
	6	F	86	17
	26	F	86	17
	11	M	85	19
	20	F	85	19
	21	M	85	19
	23	F	83	22
	7	M	82	23
	30	M	80	24
Group IV.				
	2	M	79	25
	22	M	78	26
	32	M	78	26
	31	F	77	28
	24	F	75	29
	27	F	72	30
	28	F	71	31
	29	M	70	32

English 4.

	Pupil No.	Sex.	Grade.	Rank.
Group I.				
	12	F	93	1
	10	F	93	1
	4	F	92	2
	8	M	91	4
	14	M	91	4
	7	M	91	4
	21	M	91	4
	16	F	90	8
Group II.				
	9	M	90	8
	15	F	90	8
	25	F	90	8
	3	F	90	8
	5	F	90	8
	19	F	90	8
	1	M	88	15
	17	M	87	16

English 4 (continued).

	Pupil No.	Sex.	Grade.	Rank.
Group III.				
	2	M	85	17
	23	F	84	18
	11	M	82	19
	20	F	80	20
	31	F	79	21
	24	F	79	21
	13	F	78	23
	6	F	78	23
Group IV.				
	30	M	77	25
	18	M	75	26
	22	M	75	26
	32	M	75	26
	28	F	74	29
	27	F	73	30
	26	F	70	31
	29	M	60	32

From the figures in the four subjects which have been tabulated above we were able to compile a composite table showing the group standing for each pupil in four successive years.

Pupil No.	English 1.	English 2.	English 3.	English 4.
8	I	I	I	I
4	I	I	I	I
5	I	I	II	II
16	I	I	I	I
3	I	I	II	II
12	I	I	I	I
10	I	I	I	I
14	I	II	II	I
25	II	II	I	II
1	II	III	II	II
9	II	II	I	II
17	II	II	II	II
11	II	II	III	III
15	II	I	I	II
6	II	III	III	III
19	II	II	II	II
24	III	IV	IV	III
2	III	II	IV	III
20	III	III	III	III
31	III	IV	IV	III
18	III	III	II	IV
7	III	III	III	I
13	III	IV	II	III
21	III	III	III	I
22	IV	IV	IV	IV
30	IV	III	III	IV
26	IV	III	III	IV
29	IV	IV	IV	IV
28	IV	IV	IV	IV
27	IV	IV	IV	IV
32	IV	IV	IV	IV
23	IV	III	III	III

Again by the above table we are able to learn much as to the correlation of excellence during successive years of study among the pupils forming the groups studied. Perfect group correlation is illustrated by numbers 8, 4, 16, 12, and 10 in group I, by numbers 17 and 19 in group II, by number 20 in group III, and by numbers 22, 29, 28, 27 and 32 in group IV. In brief 13 out of 32 pupils were in the same group for all of the four years. Of the remaining 19, fourteen varied only from one group to a connected one in the rank scale, from I to II, II to III, etc. No pupil appeared in all four of the groups. We may conclude, with regard to the group studied, (1) that there is a correlation of excellence in successive years of study; (2) that the most perfect correlation exists among the brightest and among the most stupid children, or in groups I and IV; (3) that the least perfect correlation exists in the medium group, representing students of average ability; and (4) that never, so far as shown by our test,—and probably very rarely in any case,—does a pupil rank among the brightest students one year and among the most stupid another. And if we compare these results with those of our first problem, we find (5) that a more perfect correlation exists between excellence in one study during succeeding years than exists between excellence in various studies of different nature. It might be pointed out that a better test of the correlation of excellence in succeeding years would have been made by taking the general averages for each year, rather than the average in one subject, in this case English. However, in as much as the subjects studied one year might be more difficult than those studied the next, and in as much as the pupils might, under the elective system, have studied the subjects used in the tests in different years, we decided that four years of English would form a fairer basis of study than four years of general averages. It is interesting to note that in general the same pupils appear in each group for both correlations; thus inviting the conclusion that, with the group studied, ability and stupidity are not only fairly constant in all subjects, but are also fairly constant in successive years of study.

(3) *Correlation Between Standings of Boys and Girls.*

Our third purpose was to determine what correlation might exist between the standing of the average male student and the average female student. It was impossible to secure an equal number of boys and girls for our investigation but the difference in numbers is so slight as to have little or no effect upon the general conclusions. Of the thirty-two pupils, 18 were girls and 14 were boys. Taking the grades which have been tabulated in the preceding pages we were able to find the average in each study for both sexes. The results were as follows:

	Grade of Average			
	Girl.	Boy.	Better.	No. of Pts.
Algebra	84	84	—	—
Civics	90	89	Girl	1
American History	86	86	—	—
Geometry	81	79	Girl	2
Latin	82	77	Girl	5
English: 1-4	86	84	Girl	2
General Average	85 minus	83 plus	Girl	1 plus

From the above figures we draw the following conclusions regarding the group studied:—(1) the average girl is as good a student in algebra and geometry as the average boy; in fact perhaps slightly better; (2) the average girl student excels the average boy student in Latin to a greater degree than in any of the six subjects selected; (3) the average girl seems to be slightly more intelligent than the average boy; or perhaps she goes less into outside activities and therefore gives more time to the preparation of her studies; and (4) in none of the six subjects does the average boy excel the average girl.

(4) *Variability in Excellence As Related to Sex.*

In this problem we sought to determine the correlation which might exist between the variability of excellence in the male student and that in the female student. We have seen that, in the group studied, the average girl ranked slightly higher than the average boy. Does she also rank highest in the scale of attainment? To solve this question we investi-

gated the sex of the pupils who ranked 1, 2 and 3 in each of the six subjects used. The following results were obtained:

Rank.	Algebra.	Civics.	Am. Hist.	Geometry.	Latin.	English.
1.	Boy	Boy	Boy	Boy	Girl	Boy
2.	Girl	Boy	Girl	Boy	Girl	Girl
3.	Girl	Girl	Girl	Girl	Boy	Girl

If we now consider a rank 1 as worth five points, a rank 2 as worth three points and a rank 3 as worth one point we are able to compute a total which shall show a fair comparative basis. The boys obtained five firsts, two seconds, and one third; or a total of 32 points. By the same method the girls with one first, four seconds and five thirds, obtained 22 points.

We then proceeded to take up the same problem from a negative standpoint, determining the sex of those students who finished in the last three places in the scale of rank for each subject. Rank 1 in this table is therefore the last or poorest student, 2 the next to the last, etc.

Rank.	Algebra.	Civics.	Am. Hist.	Geometry.	Latin.	English.
1.	Boy	Girl	Boy	Boy	Boy	Boy
2.	Girl	Boy	Girl	Boy	Girl	Girl
3.	Boy	Girl	Boy	Girl	Girl	Girl

Figuring the total number of points as in the figure above, this time from a negative viewpoint, we find the sum for the boys to be 33 and for the girls 21.

In other words, as a result of Problem IV it seems clear that (1) boys are more likely to rank at the top of the grade scale, and (2) that they are also more likely to rank at the bottom of the grade scale. In short the generally accepted theory that the chances for either exceptional ability or exceptional dullness are greater among boys than among girls is borne out by our group.

THE RELATION OF LENGTH OF MATERIAL TO TIME TAKEN FOR LEARNING AND THE OPTIMUM DISTRIBUTION OF TIME.

DARWIN OLIVER LYON,
Columbia University.

PART III.

One thing, probably the most important, that may be said in favor of the "once-per-day" method so far as economy is concerned, is the fact that material memorized by this method is retained for a much longer period than that memorized by the "continuous" method. This is probably its chief, if not its only advantage.

As no other subject was available who would undertake all of the various tests described in Part II, I have no complete curves for comparison. I have, however, the records[1] of six subjects on various parts of the test, e. g., one subject memorized a 500 word passage by the "continuous" method and then memorized it by the "once-per-day" method. Another subject memorized 48 nonsense syllables by the "continuous" method, 100 digits by the "continuous" method, a passage of 500 words by the "continuous" method and 30 stanzas by the "once-per-day" method. Space does not admit an entire reproduction of the records of these six subjects.[1] As one would expect, however, in an experiment of this kind, the various subjects differed greatly.

On another set of students[2] (fourteen Normal College girls) a somewhat different test was tried, the results of which, since they take but little room and are valuable for comparison with some of the preceding tables, are given below:

[1]Some of these have already been given in Tables G, H, K, and N of Part I.
[2]These fourteen students were selected from the Junior and Senior classes of the Albany Normal College and were selected as being the fourteen foremost out of over sixty students, i. e., they stood highest in their general average in class.

TABLE O.

1	2	3	4	5	6	7	8	9	10
Subject	Material Used.								
	Nonsense Syllables			Digits			Prose		
	10	20	40	20	100	150	100	300	500
B. B.....	5 min.	10 min.	28 min.	3 min. 15 sec.	57 min.	1 hr. 54 min.	8 min.	25 min.	42 min.
Ed. W.....	5 min.	12 min.	31 min.	3 min.	46 min.	1 hr. 19min.†	10 min.	24 min.	59 min.
El. W.....	6 min.	13 min.	36 min.	2 min. 30 sec.		1 hr. 55 min.	12 min.	19 min.	1 hr. 7 min.
E. F.....	7 min.	12 min.	37 min.	6 min.	54 min.		14 min.	47 min.	1 hr. 38 min.
E. B.....	11 min.	20 min.	45 min.	8 min.	1 hr. 11 min.		13 min.	40 min.	1 hr. 43 min.
H. B.....	13 min.	24 min.	58 min.	4 min.	1 hr. 37 min.		16 min.	26 min.	57 min.
A. K.....	12 min.	23 min.	38 min.	7 min. 30 sec.	58 min.	2 hr. 16 min.	19 min.	29 min.	1 hr. 28 min.
A. H.....	15 min.	29 min.	1 hr. 10 min.	6 min.	1 hr. 17 min.		15 min.	32 min.	1 hr. 15 min.
E. E.....	12 min.	18 min.	51 min.	9 min.	1 hr. 3 min.		21 min.	37 min.	
F. Wi.....	16 min.	27 min.	1 hr. 17 min.	5 min.	1 hr. 22 min.		17 min.	36 min.	45 min.
R. W.....	17 min.	31 min.	1 hr. 39 min.	7 min.	*		18 min.	51 min.	2 hr. 13 min.
A. Q.....	13 min.	34 min.	2 hrs. 4 min.	10 min.	*		17 min.	48 min.	1 hr. 21 min.
E. A.....	17 min.	37 min.	57 min.	11 min.	*		35 min.	1 hr. 18 min.	*
F. Wo.....	16 min.	36 min.	*	4 min. 45 sec.	2 hr. 16 min.		31 min.	41 min.	*
Aver.	12 min.	23 min.	58 min.	6 min. 34 sec.	1 hr. 14 min.	1 hr. 51 min.	18 min	38 min.	1 hr. 17 min.

*Given up after 2 hours.

†This subject's time for 200 digits was 1 hr. and 49 minutes.

Of the various individual differences in the group of six referred to on the preceding page, I found the greatest to occur with digits and nonsense syllables when memorized by the "once-per-day" method. I mean by this that the results obtained for memorizing such material by the "once-per-day" method differed more widely from the "continuous" method (in my own case) than did prose or poetry. To elucidate this fact, I give in Table P, the results of a certain experiment. Briefly stated, this experiment was as follows:

Sixteen subjects were selected from a list of over 100 as having averaged the best in a certain miscellaneous set of memory experiments. Ten of the sixteen subjects[3] occurred in the group of fourteen referred to on the preceding page. These sixteen names were then mixed up and eight selected at random for work on digits. The remaining eight were allotted prose. Of the eight digit-subjects, four were given a set of fifty digits, the other four were given a set of 200 digits. Of the eight prose-subjects, four were given a passage of prose 250 words long and the remaining four were given a pasage of prose 1000 words long. The subjects were then read the directions and rules of the experiment. Briefly stated these were that the subject would be called on to read the material allotted her once a day, and once only (Saturday and Sunday included) until she felt confident she could write the passage without error. The method of scoring these reproductions and the methods of deducting for attempted reproductions that were not perfect enough to consummate the experiment, was somewhat elaborate. Suffice it to say that the scores given were made on a percentage basis of *perfection = 100*. It was directed that the subject read the passage at her usual rate of reading, thoughtfully, i. e., understandingly and either aloud or to herself as she preferred.

Table P gives the results of this experiment. They are somewhat different from what I had been led to expect and in one sense of the word, considering that the subjects were all "selected," are somewhat disappointing. It will be noticed that of the eight subjects assigned prose, all

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[3]All the subjects were girls. They averaged in age from 19 to 23.

but one finished.[4] The average number of days for the subjects using the 200-prose passage was 29 days. The average time taken for those reading the 1000-word passage was 48 days.[5] Were the subject E. S. to be excluded the number would, of course, be lower. All of the subjects using the set of 50-digits finished within the 60 day limit; their average time is 41 days. With the 200-digit group of subjects the results were rather unsatisfactory. They were certainly (with reference to the experiments on myself) most unexpected. As will be seen from the table, only one of the four subjects, was able to reproduce satisfactorily[7] the set of 200-digits within the time limit. The remaining three were requested to write

TABLE P.

1	2	3	4	5
Subject	Material	Days	Average No. Days (Using Column 5 in the calculation)	Score at Expiration of 60 days[6]
E. F.	50 Digits	40	41	
A. K.	50 Digits	37		
E. A.	50 Digits	48		
F. Wo.	50 Digits	39		
Ed. W.	200 Digits			92
B. B.	200 Digits	51	68	84
El. W.	200 Digits			
A. H.	200 Digits			67
E. B.	200 Prose	27	29	
F. Wi.	200 Prose	36		
A. Q.	200 Prose	24		
F. S.	200 Prose	28		
H. B.	1000 Prose	40	48	
E. E.	1000 Prose	49		
R. W.	1000 Prose	28		
E. S.	1000 Prose			89

[4]Force of circumstances necessitated a discontinuance of the experiment after 60 days.

[5]Including the subject E. S. by using her "score" in the calculation.

[6]At the end of 60 days, those who had not completed the experiment were requested to write down as much of the prose passage, or set of digits, as possible. These reproductions were then "scored" on a percentage basis of "Perfection = 100." From these scores the probable number of days was then calculated in order that this might be used in calculating the "Average Number of Days" in Column 4.

[7]Space does not permit here giving the method of scoring the reproductions. Suffice it to say that with the set of 50 digits a perfect score was 100 and with the 200-digit set, 400. An error of 4 points was allowed for the 50-digit set and 16 points for the 200-digit set. As previously explained, it is undesirable for many reasons to insist on a perfect reproduction. In fact in general it is best in memory experiments, where a comparison between the individuals is to be made, to continue the experiment only until the first subject has "finished," and then grade the others accordingly.

down as much as they were able of the material so that a score of some sort could be placed on their attempted reproductions. As shown on the table, their scores are fairly high. The most interesting fact, however, is that at the end of 40 days—the scoring of an "attempted reproduction" of these three subjects gave figures nearly as high.

* * * * * * *

As has already been stated, (Part I), these two "methods"[8] of memorizing contribute but a small fragment to the much larger problem of the *Optimum Distribution of Time*[9]—a problem which is but a minor contribution to the still more general problem of *Economy in Learning.* Such a problem, as we have already said, would have to consider not only the various sub-divisions of time, sub-divisions of material,[10] nature of material, time of day, etc., but would have to include an investigation of such things as,—loud v. silent reading, fast v. slow reading, etc., etc.

As a matter of fact, no single method can be set down as being the most economical for everyone. The problem is not, *What is the most Economical Method?*, but *What is the most Economical Method for Mr. Brown and how can he find this method out?*

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Unfortunately space does not allow publication of all of my data. Were I to draw conclusions, however, from all my

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[8]i. e. the "continuous" method and the "once-per-day" method.

[9]It has been proven by experiment that a certain effort expended at intervals over a period of several days will give better results than if this same effort is expended in one "sitting." We do not, however, know the most effective distribution possible,—nor do we know whether this "most effective distribution,"—supposing it had been ascertained,—would apply to one material as well as to another. It has been proven that in general it is better if, say *one* hour is to be spent on a list of 40 nonsense syllables, to divide this hour up into sections, but the most favorable distribution has never been determined.

[10]This problem of the most favorable sub-division of the material, or the most enonomical unit for committing to memory, is one that has received the attention of numerous investigators. The various phases of this subject have been taken up by Steffens, Pentschew, Schneider, Larguier des Bancels, Pyle and Snyder, and Lakenan. Steffens found that it was better not only not to divide a stanza of poetry into parts, but that for poems of moderate length, it was better not to divide the poem into stanzas. Schneider says that even for poems of 12 or 15 stanzas, the "best" (and as a rule he means by this the most economical) method, is to read and re-read the entire poem.

experiments, I should say that the following are the most significant:

1. For meaningful material such as prose and poetry the total time consumed by the "once-per-day" method is about the same as that needed by the "continuous" method. With both methods with passages of 1000 words or less the time varies directly as the length of the passage.

2. With nonsense syllables, digits, and all material memorized by motor associations the total time spent by the "once-per-day" method may be roughly said to vary as the length of the passage; by the "continuous" method, however, the time would seem to vary as the square of the length of the passage.

3. Visual presentation would seem to be better than auditory presentation, but a combination of the two, e. g., when the subject reads his own material aloud, would seem to be more economical and to give greater retentiveness than either. The superiority of visual over the auditory presentation would *not* seem to be alone due to the fact that two senses instead of one are called into play, but because we can read more easily and more exactly than we can hear;—a second reason is that visual presentation allows us to choose our own rhythm and rate of reading.

4. Things that make sense, i. e., meaningful material are learned in larger units than non-meaningful material. The subject is able to take the material as a whole for the reason that it makes sense, i. e., that it means something to him. In one sense of the word also, one might say that with meaningful material the subject has already (i. e., previous to the experiment) memorized a large part of it.

5. Subjects who have lately been taught mnemonic systems are apt to over-do them, i. e., they endeavor to apply them more often than is for their own good. Mnemonics only pay when easily formed and when easily remembered. Very often the task of forming associations and the difficulty of remembering them is greater than would have been the task of using, what we might term for want of a better word, "brute force."

6. With nonsense syllables, not only does one have to learn the constitution of the individual syllable, but the order of the

syllable as well. For words, their *order* is practically the only thing necessary, i. e., provided associations between the words have been formed.

7. With reference to the problem of the *most favorable distribution of single readings,* referred to several times in the preceding pages, I would say that "the most general statement that can be made, taking all materials and methods of presentation into consideration, is that the most economical method is to distribute the readings over a rather lengthy period,—the intervals between the readings being in arithmetical proportion. For example, with one individual in memorizing a poem of 20 stanzas the highest retentiveness was obtained by distributing the readings as follows: 2 hours, 8 hours, 1 day, 2 days, 4 days, 8 days, 16 days, 32 days, etc. The practical bearing of the results obtained on education in general"[11] is that when associations have once been formed they should be recalled before an interval so long has elapsed that the original associations have lost their "color" and cannot be recalled in the same "shape," time, and order. In general it was found "that the most economical method for keeping material once memorized from disappearing, was to review the material whenever it started to 'fade.' Here also the intervals were found to be, roughly speaking, in arithmetical proportion. For similar reasons the student is advised to review his 'lecture-notes' shortly after taking them, and if possible, to review them again the evening of the same day. Then the lapse of a week or two does not make nearly so much difference. When once he has forgotten so much that the various associations originally made have vanished, a considerable portion of the material is irretrievably lost."[12]

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The time taken to memorize nonsense-syllables as found by the various experimenters who have worked with them, is far from being always the same, even when the subjects are of the same age and intellectual standing. An examination of

[11] *The Optimal Distribution of Time, and the Relation of Length of Material to Time Taken for Learning:* D. O. Lyon. The Journal of Philosophy, Psychology and Scientific Methods, Vol. IX, No. 14.

[12] Op. cit. page 386.

the various sets of nonsense syllables used by these experimenters has proven to me that this difference in time is largely due to the great differences in the difficulty of the nonsense syllables used.[13] Experiments of my own have confirmed this.

Were one to attempt to repeat the prose experiment, the results of which are given in Table O, he would arrive at approximately the same results if he used bright students, say the best quarter of a class of 60 or 70, even though he selected his prose passage at random from any novel.[14]

It is probable that with digits also, his results would be much the same. When, however, he came to nonsense syllables, his results would be liable to differ widely unless the sets of syllables used were equal in difficulty to those used by me. I give below the set of 40 syllables used in the experiment in question and would advise their use should anyone attempt to repeat the experiment for purposes of comparison.

KUV	ZID	KIF	NUZ	POZ
YAB	VEL	HEB	BOF	NIV
SEF	NAZ	YIF	JEP	DUT
BUP	JID	KEV	VOB	KEL
KED	LUP	NAD	FEG	VUM
TIB	MIV	TEF	YAB	JOP
WEF	VOB	KIV	VUZ	BAV
BOL	RUZ	JED	DIB	NID

Short sets of nonsense syllables are easily made,—repetitions of syllables being easily avoided. There are, for the English language, only about 90 fairly good nonsense syllables, and of these nearly 80 begin with J or N, end with B or D, or have O or U as their vowel. In making a series of say 40 nonsense syllables, from the 90 possible ones, it will be

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[13]As an example of what I mean, I here give two examples of a series of nonsense syllables as given by Watt in a footnote in his book entitled "*The Economy and Training of Memory.*"

"Bax, goul, fos, hiv, ped, vaub, jum, cor."

It is obvious that with such a set of nonsense syllables associations are very easily formed, e. g. with one individual these 8 syllables were memorized in 1¾ minutes by using the following words in place of the syllables which they so nearly resemble:

Box, ghoul, "fossa," live, pedestal, vault, jam, "body;"—

all these being easy of recall in their proper order by visualizing a picture of a certain burial.

[14]My own prose passage with the group of 14 Normal College Students was taken from Dewey's *School and Society.*

found, *if the rules given in the foot-note below*[15] *are followed,* that after the list has grown to 25 or 30, more than half of the syllables drawn have to be thrown back. Lists of 60 or more, are made only with considerable difficulty, and it is frequently found necessary to throw the syllables back[16] and start over again. Sets of 90 syllables or over must contain either a certain number of undesirable[17] syllables or a number of repetitions. For example, the set of 104 used by me with the "once-per-day" method contains three "DUT"s, two "BOF"s, two "POF"s, and two "ZIM"s;—not that these repetitions could not have been avoided, but their avoidance would have necessitated either the use of certain undersirable syllables, or a recasting of a large part of the entire set. This set of 104 syllables is given below:

MIV	VUD	LUD	JED	NOL	NAV
ZAD	FEV	FEG	KOV	PAB	FUD
PIB	ZIB	DUT	SEB	LIR	PEM
KED	LOD	KIB	TID	JEP	BOK
LUP	JAZ	NAZ	YUP	KOV	
TAV	POF	BOD	RUZ	TID	
NID	DUT	JEP	KEV	BUP	
HEB	BOV	WIB	YIM	YAB	
VUS	ZIR	NUZ	NUV	ROZ	
ZIM	VEL	ROV	JAD	HEB	
KUV	PID	YID	POZ	NIV	
JID	JUR	TEF	LEB	SEF	
BOF	NAD	BOZ	TID	BOL	
YAB	VOB	PEV	FEK	ZIM	
WEF	YIF	JUF	RUL	VED	
DIB	TEB	VIB	BOF	NAZ	
JAL	JOD	NAJ	ZID	DUT	
HUF	ZUB	FEK	YAB	POF	
NIZ	NIV	HUZ	SEF	VUM	
TOB	KOB	BOP	HUV	JOP	

[15]Rules for forming sets of nonsense syllables from the 90 nonsense syllables previously selected:—

1. Syllables must be drawn by chance.
2. Initial consonants must not be the same unless separated by two or more syllables.
3. End consonants must not be the same unless separated by two or more syllables.
4. Vowels must not be the same unless separated by two or more syllables.
5. The initial consonant of one syllable must not be the same as the final consonant of the preceding syllable.
6. Excepting sets of 72, or over, syllables may not be repeated.

[16]My method was to mix up the syllables in a box and draw them out at random—arranging them one under the other. Whenever a syllable was found to violate any of the above rules it was thrown back.

[17]By "undesirable" syllables I mean syllables that (1) are difficult of pronunciation, e. g., YUF; or (2) that permit of quick and easy associations, e. g., LUK.

(THE END.)

COMMUNICATIONS AND DISCUSSIONS.

CONCERNING PSYCHO-CLINICAL EXPERTNESS.

A great deal has been said recently regarding what constitutes psycho-clinical expertness, and what kind and amount of training are necessary to fit one to make mental examinations of school children.

The purpose of this note is to raise the question whether, in a field of applied science as new as this one, there may not be danger of the critic assuming an unduly contemptuous attitude towards the efforts which are put forth by the average worker, and whether there is not danger also of evaluating over-critically the work of the scientific explorer after methods and principles of mental examinations. The problems, indeed, are so new and difficult that the most cautious and competent worker must progress slowly and perhaps with occasional stumbling.

No one, of course will deny that it is legitimate to call attention to the dangers of amateur mental testing, of taking too seriously the mental diagnoses made by school nurses, teachers and doctors, and of confusing the complex and baffling science of clinical psychology with the mechanical use of the Binet intelligence tests. At the same time it is well to remember that the methods of clinical psychology, even at their best, are still in an embryonic stage of development and that no one, however sagacious or well-trained in psychological technique, can rightfully lay claim to any great degree of psycho-clinical expertness.

The writer would especially protest against the publication of contentious articles by workers in this field whose purpose appears to be that of disparaging the results of others. Some of the articles of this nature which have found their way into print are colored in every aspect by bombast, pretentiousness and shockingly open claims to recognition. Some of them are hardly less than bawling self-

advertisements in which word-coining and word-juggling take the place of scientific content.

Let all of us who are really concerned about the progress of this new and fascinating division of applied psychology be content to work by the best methods now available, correcting and amplifying these as rapidly as possible by positive contribution of fact, and let us cease wasting energy hysterically over the "dangerous" and "pernicious" methods of "incompetent" psycho-clinicists.

LEWIS M. TERMAN.

Stanford University.

EDMUND BURKE HUEY.

The death of Dr. Edmund Burke Huey, at Connell, Washington, which was announced in the last number of this JOURNAL, signifies such a loss to the science of education that it justifies a more complete comment at this time.

Dr. Huey was born at Curllsville, Pa., December 1, 1870. Most of his early life was spent in Pennsylvania and Indiana. In 1891 he entered Grove City College, and after a year there registered at Lafayette College, where he completed the requirements for his degree in Arts in 1905. While in college he was recognized as a student leader not only in the work of the classroom, but in the literary societies, the oratorical and debating contests, in certain lines of lighter athletics, and in college social affairs. His high rank as a student is indicated by the fact that he won prizes in oratory, debating, English, and philosophy, and was graduated valedictorian of his class. The two years immediately following his graduation were spent as a teacher of Latin in the Harry Hillman Academy, Wilkes-Barre, Pa. During this period Mr. Huey further developed his philosophical interests in making a study of James's two-volume work on psychology and several volumes of Wundt in the original. At this time he seems to have definitely made up his mind to devote himself to the field of psychology.

Receiving an appointment to a scholarship in Clark University he entered that institution in the fall of 1897 and continued there until he received his doctorate in psychology two years later. His close application to his work in the University brought him to the verge of a collapse, so that a less determined man would have prob-

ably felt himself compelled to spend a couple of years in complete rest. Here, as in other crises in his life, however, he ignored his physical limitations and entered vigorously upon the career of teaching as professor of psychology and education in the State Normal School of Moorhead, Minn., a position which he held for two years and which he resigned in the spring of 1901 in order to spend a year in Europe. This year was spent in graduate study, chiefly in the University of Berlin.

On his return to America in 1902 Dr. Huey accepted an appointment as professor of psychology in the newly established State Normal College in Miami University, Ohio. Here he remained for one year, resigning to resume his graduate studies at Clark as assistant and honorary fellow in psychology. After one year as assistant in Dr. Sanford's laboratory he accepted a call to organize a department of psychology and education in the Western University of Pennsylvania at Pittsburgh. Meanwhile, Dr. Huey was continuing his researches begun at Clark University in the psychology and pedagogy of reading, which he finally published under that title, and which was one of the first scientific studies in experimental education in this country. Through all these years Dr. Huey maintained a constant uphill fight against ill health. In order to keep at work he had to establish the most systematic habits in work, recreation, and diet. His vacations were spent in the West, or in the quiet of the mountains in search of relaxation and strength. But never even in the periods of greatest physical weakness or mental distress did he entirely give up his work. He was one of the most persistent and systematic workers the writer has ever known. His devotion to science in the face of the most adverse conditions was a constant inspiration to those who observed him.

After the publication of his book on reading, Dr. Huey gradually developed his interest in the psychology and education of defective and exceptional children. In 1908 he resigned his position in Pittsburgh for a year abroad with Janet in Paris, where as a student and assistant in clinics and hospitals he fully equipped himself for a career in this newly-established and just-developing field. His letters written from Paris at this time are full of enthusiasm and optimism, although every hour of his time was being measured by carefully adjusted schedules, and every ounce of energy was being conserved with the utmost vigor. At no time during this period

was he free from physical weakness or a sense of imminent collapse, though these things found little place either in his correspondence or in his conversation.

Returning to America in 1909 Dr. Huey accepted a call to establish a department of psychological research in the State School and Colony at Lincoln, Ill., where he remained until the winter of 1911. In his examination of cases at Lincoln he accumulated the material which he organized and published in 1912 under the title "Backward and Feeble-minded Children." The year 1912 he spent in work at Johns Hopkins University as assistant to Dr. Adolf Meyer in the clinic of the Johns Hopkins Hospital. His hope that the milder climate of Baltimore might improve his health proved ill-founded. He gradually lost strength, and after several heroic rallies was compelled to give up his work at the end of the year and seek recovery in Southern California. Here his decline continued, whether at the sea-side, in the mountains, or later in the hospital. In the late autumn he was taken to the home of his sister at Connell where he quietly passed away December 30, 1913. At letter written by him exactly one week before his death contained no hint of surrender, but prophesied, optimistically, a return to work in a little while.

For several years prior to his death Huey had been collecting materials for a work on general psychology, written from the genetic point of view. Most of his working hours during the last two years had been devoted to the organization of his notes with this end in view. While he was in the hospital in Los Angeles all his notes and manuscripts were lost in a fire in the boarding house where he had left them. This blow seemed for a while to stagger even his heroic optimism, but he soon ceased to speak of the loss and began to look forward to a re-writing of the burnt manuscripts. In Dr. Huey's death science has sustained the loss of a very promising contributor. The new department of psychology to which he had finally given himself, could ill afford to part with his services. His hosts of friends will miss his quiet but cordial greetings at the annual scientific meetings. But he will live in the memories of all who really knew him, as a man of splendid endowments, of the highest scientific ideals, of persistent and systematic habits of work, and of a splendid heroic optimism in the face of overwhelming discouragements.

W. G. CHAMBERS.

University of Pittsburgh.

THE DOCTRINE OF FORMAL DISCIPLINE IN THE LIGHT OF EXPERIMENTAL INVESTIGATION.

(Author's abstract)[1]

The first 60 pages of this thesis, of which no abstract is here attempted, deal with the historical development of the doctrine of formal discipline. It is pointed out that in practice formal discipline is not an issue in determining the curriculum and methods of the elementary, but rather of the secondary school, and that the experimental investigation of the problem has heretofore been for the most part limited to studies with college and university students or instructors: only recently have experiments been conducted with school children.

The present investigation deals with a single topic, that of the effect of 'training the observation,' to use the language of everyday life.

Subjects.

The subjects were all pupils in the first term of a New York City high school, and they were distributed into three classes.

Class 1 had 12 boys—20 girls.
Class 2 had 10 boys—18 girls.
Class 3 had 12 boys—14 girls.
The ages of the pupils varied from 12-17.
Class 1, average age, boys 13.7—girls 14 years.
Class 2, average age, boys 14.1—girls 13.8 years.
Class 3, average age, boys 13.8—girls 14.1 years.
The tests were given in the afternoon.
Preliminary, April 22-30, 1912.
Practice, May 15-28.
Final, June 3-11.

Practice Series.

From averages obtained from the tests of the first series, each class was divided as nearly equally as possible. In each class, as far as possible, the endeavor was made to place the pupil receiving the highest average on the side which was to receive no practice,

[1]The original manuscript of which this article is an abstract is a thesis submitted in partial requirement for the degree of doctor of philosophy, New York University.

while the next highest was placed in the division to be practiced. Thus among successive pairs usually there was a slight advantage on the non-practiced side, and the totals showed the non-practiced side to have the advantage at the start.

On May 15, the practice series was begun and continued for ten minutes daily until the expiration of two weeks. While half of the class were observing and describing biological material the non-practiced half were writing answers to questions on topics previously assigned for home-study from the text-book. The text-book work was assigned to all for outside work but only the non-practiced half wrote answers to questions.

The tests of the two series consisted of biological and non-biological material. The former comprised stems, flowers, leaves, seedlings; the latter, pictures, nonsense syllables of 2 letters, nonsense and geometrical figures, and two-place numbers. The biological material was observed for a certain length of time and then written descriptions were made. The non-biological material was exposed for a stated amount of time and then reproduced on paper. Ten-minute descriptions of leaves and flowers were written on ten successive school days. The biological tests were rated by alloting one credit for every descriptive noun, adjective, verb, or adverb.

The non-biological tests were rated by allowing 10 credits for every correctly placed syllable, number, figure, etc., 9 credits if misplaced one to right, left, above, or below, 8 credits if 2 to the right, left, above or below, etc. The averages of the results of each pupil's work in the eleven tests were made the basis of the division of the classes for the practice series. The tests of the practice series were rated in the same manner as the biological tests.

Computation of Results.

Averages were made for each pupil in each series from the rating given to each test as described above. Ratings were reduced to the percentage basis.

Using the data acquired by both methods, tables were made comparing the practiced and unpracticed pupils of each class in two respects—1, in regard to their ability in biological tests; 2, ability in non-biological tests.

Only the summaries of the tables are submitted.

TABLE 1.—*Total of Percentage Ratings.*

Class.	Boys.	Practiced. Prel.	Practiced. Final.	Unpracticed. Prel.	Unpracticed. Final.
1	12	3143.04	3963.28	3344.63	3627.60
2	10	3121.47	3538.55	3300.55	3534.46
3	12	3879.82	*3985.30	4048.53	*3931.53
Total	34	10144.33	11487.13	10693.71	11093.59
			10144.33		10693.71
			increase 1342.80		increase 399.88
Class.	Girls.				
1	20	6249.87	6630.22	6429.35	5941.74
2	18	5683.01	6651.89	5848.47	6200.93
3	14	4119.51	*4207.26	4228.09	*4449.69
Total	52	16052.39	17489.37	16505.91	16592.36
			16052.39		16505.91
			increase 1436.98		increase 86.45

*Test 1 omitted.

Table 1 shows that in the eleven final tests, the 17 practiced boys increased 1342.8 an increase of 7.18 for each individual test, while the unpracticed boys increased only 2.13 per test. The 25 girls of the practiced half in the final test show an increase over the 26 girls of the preliminary tests of 1436.98, an increase of 5.22 per test whereas the unpracticed made an increase of only .31 per test.

TABLE 2.—*Comparison of Percentage Ratings in the Biological and Non-Biological Tests Before and After Practice.*

		Practiced.				Unpracticed.			
		Biol.		Non-Biol.		Biol.		Non-Biol.	
Class.	Boys.	Prel.	Final.	Prel.	Final.	Prel.	Final.	Prel.	Final.
1	6	1345.24	1614.64	1797.80	2268.64	1193.43	1064.62	2155.20	2439.24
2	5	1586.83	1555.62	1534.64	1932.93	1474.27	1697.33	1725.32	1771.13
3	6	1355.96	1803.54	2135.24	2181.76	1333.33	1496.78	2216.20	2434.75
Total	17	4288.03	4973.80	5467.68	6383.33	4001.03	4258.73	6096.72	6645.12
			4288.03		5467.68		4001.03		6096.72
			685.77		915.65		257.70		548.40
Class.	Girls.								
1	9	2555.00	2979.25	3150.12	3329.20	2641.27	2523.60	2964.28	3245.75
2	9	2560.21	2772.88	3122.80	3575.01	2429.39	2410.76	3269.68	3579.16
3	7	1434.81	1600.23	2147.64	2447.03	1542.05	1523.14	2291.28	2541.05
Total	25	6550.02	7352.36	8420.56	9351.24	6612.71	6457.50	8525.24	9365.96
			6550.02		8420.56	6459.50			8525.24
			802.34		930.68	—155.21			840.72

Table 2 shows that the 17 boys on the practiced side in the Non-Biological tests made an increase in the final series of 915.65, an average increase of 8.97 per test for each of the 6 tests, while the corresponding unpracticed half made an average increase of only 5.37 per test. The 25 girls of the practiced half in the Non-Biological tests made an increase in the final series of 930.68, an average increase of 6.2 per test for each of the 6 tests, whereas the unpracticed half made an average increase of only 5.6 per test. In the Biological tests the 17 boys made an improvement in the final series of 685.77, an increase of 8.06 per test for each of the 5 tests, whereas the unpracticed boys increased only 3.03 per test. The 25 girls of the practiced side increased in the final series to the amount of 802.34 over the preliminary, an average increase of 6.41 per test for each of the 5 tests, while the unpracticed side made an average decrease of 1.24 per test.

TABLE 3.—*Comparison of Original Ratings of Preliminary and Final Series.*

		Practiced.		*Unpracticed.*	
Class.	Boys.	Increase.	Decrease.	Increase.	Decrease.
1	12	372	...	151	...
2	10	171	...	156	...
3	12	201	...	219	...
Total	34	744		526	
Class.	Girls.				
1	18	387	...	56	...
2	18	350	...	212	...
3	14	160	...	28	...
Total	50	897		296	

This table was complied by comparing partners in the preliminary and final series in exactly the same tests. For example, if a pupil was absent from a test of the preliminary or the final series that test is omitted from his other series and also from both of his partner's. Thus in 173 tests, the 17 practiced boys made an average increase of 4.3 per test, while the corresponding unpracticed boys increased 3.04. In 241 tests, the 25 practiced girls made an average increase of 3.72 per test while the unpracticed girls made an average increase of 1.22 per test.

TABLE 4.—*Comparison of the Percentage Ratings of Practiced and Unpracticed Compiled in a Similar Manner to Table 3.*

Class.	Boys.	Practiced. Increase.	Practiced. Decrease.	Unpracticed. Increase.	Unpracticed. Decrease.
1.....	12	771.46	....	139.23	....
2.....	10	386.08	....	266.91	....
3.....	12	489.38	....	352.00	....
Total.....	34	1646.92		758.14	
Class.	Girls.				
1.....	18	608.61	....	60.83	....
2.....	18	615.84	....	270.55	....
3.....	14	411.81	....	186.66	....
Total.....	50	1636.26		518.04	

Table 4 differs from Table 1 in that in the latter occasional absences were disregarded. The 17 practiced boys in each of the 173 tests made an average increase of 9.51, while the unpracticed made an average increase of 4.38. The 25 practiced girls in each of the 241 tests made an average increase of 6.78, while the unpracticed girls made an average increase of 2.14 per test.

TABLE 5.—*Total Averages of the Practiced and Unpracticed in the Preliminary Series.*

Class.	Boys.	Practiced. Total Average.	Unpracticed. Total Average.
1.....	12	148.35	157.07
2.....	10	146.15	149.51
3.....	12	178.06	189.15
Total.....	34	472.56	495.73
			472.56
			23.17
Class.	Girls.		
1.....	20	298.97	311.81
2.....	18	276.90	289.48
3.....	14	210.26	224.93
Total.....	52	786.13	826.22
			786.13
			40.09

The choice of the pupils for practice was based on their averages obtained in the 11 tests of the preliminary series. Table 5 shows that the unpracticed boys were superior to the practiced by a difference in the total averages of 23.17, while the unpracticed girls were superior by 40.09 to those on the practiced side.

TABLE 6.—*Summary of Term's Ratings.*

Class.	Boys.	*Practiced.*	*Unpracticed.*
1	12	1537	1435
2	10	1354	1404
3	12	1675	1731
Total	34	4566	4570
Class.	**Girls.**		
1	20	2813	2747
2	18	2841	2477
3	14	1961	2130
Total	52	7615	7354

This table shows the unpracticed boys to be superior by 4 credits while the practiced girls are superior by 261 credits. With 17 boys, the advantage on the unpracticed side is only .23 per pupil while the 26 practiced girls are superior over the unpracticed to the extent of 10.03 per pupil.

TABLE 7.—*Summary of All the Tables.*

Boys.

Table.	*Practiced.* Final.	Av.	Biol.	Av.	Non-B.	Av.	*Unpracticed.* Final.	Av.	Biol.	Av.	Non-B.	Av.
I	1342.80	7.18	.....	....	.....	....	399.88	2.13	.....	....	.....	....
II	.....	....	685.77	8.06	915.65	8.97	.....	....	257.70	3.03	548.40	5.37
III	744.	4.3	.....	....	.....	....	526.	3.04	.....	....	.....	....
IV	1646.92	9.51	.....	....	.....	....	758.14	4.38	.....	....	.....	....
V	.....	....	.....	....	.....	....	23.17	....	.....	....	.....	....
VI	.....	....	.....	....	.....	....	4.	.23	.....	....	.....	....
Girls.												
I	1436.98	5.22	.....	....	.....	....	86.45	.31	.....	....	.....	....
II	.....	....	802.34	6.41	930.68	6.2	.....	....	—155.21	—1.24	840.72	5.6
III	897.	3.72	.....	....	.....	....	296.	1.22	.....	....	.....	....
IV	1636.26	6.78	.....	....	.....	....	518.04	2.14	.....	....	.....	....
V	.....	....	.....	....	.....	....	40.09	....	.....	....	.....	....
VI	261.	10.03	.....	....	.....	....	.....	....	.....	....	.....	....

CONCLUSIONS.

It is evident from these general summaries and comparisons that the practiced pupils have excelled the unpracticed pupils. The question difficult to solve is "what is the cause?" No doubt growth, familiarity with procedure, benefits of class-work and study, and desire to excel have all contributed their share toward the increase, but these factors may have aided both sides equally. We have no means of telling. Then why the difference?

Judging from the division of the practiced groups, the better pupils were on the unpracticed side. While the class term ratings showed the better boys to be on the unpracticed side, the contrary

was true with the girls. The March rating, given before the preliminary tests began, showed the reversed condition. Very little significance can be attached to class marks as denoting general intelligence or superiority because so many extraneous factors enter in.

Considering table 2, we would naturally expect both practiced boys and girls to earn in the final series a bigger increase than their opponents in the biological tests: but how shall we explain their greater efficiency in the non-biological tests other than to ascribe it to the effects of the practice series?

NELLIE PRISCILLA HEWINS, PH.D.

New York University.

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EDITORIAL.

OHIO SCHOOL SURVEY.

School surveys may be roughly classified into three groups. First, the survey inspired by those elements in the community that are more or less hostile to the existing school management, and that employ outside persons to examine the details of school work and to set forth such defects as may be found. The New York City school inquiry is an example. Second, the survey in which the community, with the avowed co-operation of the school authorities, appeals to some outside agency for an unbiased examination of school conditions. The Baltimore survey by the United States Bureau of Education and the Vermont survey by the Carnegie Foundation are instances of this type. Third, the survey in which the work is planned and supervised by a director, but is carried out by the school people themselves. The Ohio school survey is a conspicuous example of the latter type. The direction of the survey was entrusted to Dr. Horace L. Brittain, of the New York Training School for Public Service, who had gained experience in this sort of work in the Wisconsin survey. The survey was participated in by forty-four professors in schools for the training of teachers, one hundred sixteen students in these institutions, three hundred ninety-

five superintendents of schools and other school men and women, and nine thousand teachers who supplied information to the commission. It is obvious from this organization that the survey could lay no claim to scientific accuracy or expertness, and that it would be expected to confine itself to broad general views and to considerations of practical import. This expectation is realized in the report. The field study was primarily concerned with rural and village schools, and the report aims to give an impressionistic picture of state, county, township and district supervision of these schools, the training of teachers, classroom instruction, outside co-operation, physical equipment, and miscellaneous rural school conditions. Three things in the report are of interest to scientific students of education. First, it is recommended that a bureau of efficiency and economy be established in the state department of public instruction which shall act as a clearing house for educational information, keep on exhibition in an educational museum the latest data on school construction, reports, supplies, etc., and co-operate with any educational body in the state in the investigation of administrative and instructional problems. In connection with this central bureau it is urged that a department of efficiency tests and survey be established in the college of education of the state university and in each of the four state normal schools, which shall conduct field studies and devise and apply efficiency tests in the schools within their constituencies. If this recommendation should be adopted it would put Ohio in the front rank of educational research, and would initiate a movement the beneficent effects of which would be incalculable. Second, sporadic attempts were made to employ standard scales in the estimation of the results of classroom instruction. Eighth grade compositions in Delaware county and city schools were measured by the Hillegas scale, and the handwriting of 1700 pupils was measured by the Ayres scale and compared with that of Iowa children as indicated by King and Johnson in this JOURNAL, Vol. III, p. 514. Such attempts are interesting in that they show the uses to which standard scales may be put. Finally, the appendix to the report contains elaborate questionnaires on supervision, instruction, reports, school plant, etc., which will be of value to other students of school conditions. The report may be procured by sending twenty cents in stamps to the Ohio State School Survey Commission, Columbus, Ohio.

J. C. B.

NOTES AND NEWS.

A Teachers' Pedagogical Research Society was recently formed in London, England, with the object of enabling its members to keep informed of the progress of educational investigations, and of facilitating educational research. At the inaugural meeting, held Jenuary 19, Mr. P. B. Ballard, District Inspector of Schools, gave the principal address on the topic "Pedagogical Research; its Methods and Pitfalls," and the discussion was opened by Mr. Cyril Burt, Psychologist for the London County Council. Among others interested in the organization are Professor John Adams, University of London, Professor J. A. Green, Sheffield University, Inspector W. H. Winch, Mr. B. Dumville, and Dr. E. O. Lewis. The society has a membership of ninety, and has made arrangements for a series of lectures by prominent workers in this field. The secretary of the society is Mr. Ralph Mollet, 9 Thorncombe Road, East Dulwich Grove, London, S. E.

The department of psychology at Reed College, Oregon, under the direction of Dr. Eleanor Rowland, is preparing to give a series of mental tests to the sophomore class of Reed College, and to determine the correlation of the results with college grades.

The Illinois State Civil Service Commission announces an examination on April 4 for the position of Supervisor of High Schools at a salary of $333.33 per month. This is a new office, and the successful candidate will have considerable freedom in initiating and carrying out policies and methods in connection with grading, classifying and standardizing the high schools of the state.

The general assembly of the State of Ohio recently provided for two high school inspectors at large, two to be selected from the faculty of the college of education at the Ohio State University, and one from each of the faculties of the Ohio normal colleges at Oxford and Athens and the Ohio normal schools at Kent and Bowling Green, making eight in all.

Mr. Orlando M. Baker, for many years president of the G. & C. Merriam Company, publishers of Webster's New International Dic-

tionary, died at Springfield, Mass., February 2. Mr. Baker saw many years of service as a teacher before he entered the publishing business, and always evinced a keen interest in educational progress.

Dr. Arthur Henry Pierce, professor of psychology at Smith College, died at Northampton, February 20, aged forty-four years. Professor Pierce was known for his work on space perception, for his activity in the American Psychological Association, of which he was secretary for three years, and for his conduct of the Psychological Bulletin, of which he was editor.

Professor Guy Montrose Whipple, of Cornell University, will conduct the advanced courses in educational psychology and mental tests during the summer session at Teachers College, Columbia University. He will be assisted in the work in mental tests by Mr. D. K. Fraser.

Dr. David Spence Hill, Director of Educational Research in the public schools of New Orleans, will have charge of the work in educational psychology and school hygiene at the summer session of Cornell University. Dr. Hill will be assisted by Miss Josephine Curtis, formerly instructor in psychology at William Smith College, Geneva, N. Y.

Among the appointments to the faculty of George Peabody College for Teachers, Nashville, Tenn., the following are noted: Carter Alexander, Ph.D., professor of school administration, formerly assistant professor of school administration, University of Missouri; Frederic B. Dresslar, Ph.D., professor of school architecture and hygiene, formerly special agent of the United States Bureau of Education; and Edward K. Strong, Jr., Ph.D., professor of psychology and psychology of education, formerly connected with the department of psychology, Columbia University.

Mary Theodora Whitley, Ph. D., instructor in educational psychology, Teachers College, Columbia University, has been promoted to be assistant professor in that institution.

Mr. E. C. Tolman, M.A., has been appointed assistant in psychology in Harvard University.

PUBLICATIONS RECEIVED.

(Notice in this section does not preclude a more extended review.)

BROOKS ADAMS. *The Theory of Social Revolutions.* New York: The Macmillan Company, 1913. Pp. 240. $1.25 net.

A closely reasoned work on the relations of capital to government—with particular emphasis upon the influence of the money power with courts of justice and the legal profession. Reference to the social revolutions of the past lends weight to the author's warning to capital to beware lest it undermine the confidence of the people in the courts. No instrument can be transformed more quickly into an engine of ruthless destruction.

JAMES H. BAKER. *Educational Aims and Civic Needs.* New York: Longmans, Green & Co., 1913. Pp. 183. $0.90 net.

This collection of ten public addresses from one of the veteran educators of this country presents the author's mature and seasoned reflections upon important educational topics of current interest. Perhaps the central thought of the addresses is the necessity for the reorganization of our whole educational scheme, elementary, secondary, and collegiate, to meet the changed conditions of modern life.

PHILIP BOSWOOD BALLARD. *Obliviscence and Reminiscence.* British Journal of Psychology Monograph Supplements, Vol. 1, No. 2, 1913. Pp. 82. 4s net.

An important experimental study of the retention by school children of school material committed to memory. "Reminiscence, or the remembering again of the forgotten without relearning, occurs frequently in everybody's life; in the lives of children it plays a far more important part than most of us suspect." An imperfectly memorized selection is remembered better by children after one or two days than immediately after learning. The bearing of this study upon school instruction is far reaching and deserves the careful attention of teachers.

JOHN SPENCER BASSETT. *A Short History of the United States.* New York: The Macmillan Company, 1913. Pp. xv, 885. $2.50 net.

A clear, straightforward account of the development of the United States. An excellent reference book for the high school teacher, and a good college textbook. Emphasis is laid upon social and economic factors of the development, but political and military events receive due consideration.

FREDERICK BETZ. *Aus der Jugendzeit.* New York: D. C. Heath & Co., 1913. Pp. iv, 159.

A collection of six short stories by modern German authors. It affords easy and attractive reading material for first year students.

MAURICE A. AND ANNA N. BIGELOW. *Introduction to Biology.* New York: The Macmillan Company, 1913. Pp. 424. $1.10.

An elementary textbook and laboratory guide intended for the first or second year of the high school course. The more important topics are the characteristics of living things, plant life, the higher animals, the simpler animals, human structure and life-activities, personal and general hygiene, the economic relations of organisms, and the reproduction of organisms.

JULIETTE ALEXANDRE-BISSON. *Les phénomènes dits de matérialisation.* Paris: Librairie Felix Alcan, 1914. Pp. xx, 311. 12 francs.

This curious and almost grotesque book represents an attempt to reproduce photographically and to discuss scientifically the phenomena of so-called materialisation. The author is a co-worker with von Schrenck-Notzing in the effort to subject the claims of "mediums" to scientific scrutiny. One is at a loss to determine whether, in spite of the elaborate precautions against trickery, the investigators have been the dupes of a gigantic hoax, or whether we are here brought face to face with strange and at present inexplicable phenomena of the human organism.

ALBERT F. BLAISDELL AND FRANCIS K. BALL. *The Child's Book of American History.* Boston: Little, Brown & Co., 1913. Pp. ix, 216. $0.75.

This book is a supplementary history intended for use in the fourth and fifth grades. It contains a large number of interesting anecdotes and descriptions of dramatic events in American history, and makes a strong appeal to the youthful imagination.

T. NELSON DALE. *The Scientific Spirit Applied to Living Subjects.* Pittsfield, Mass.: Sun Printing Co., 1913. Pp. 146. $0.35.

These essays present the reflections of a geologist on some of the cultural, ethical and religious problems of life. The author is of a deeply religious nature, and the chief purpose of the book seems to be to reinforce the demand for the cultivation of respect for religious values.

CHARLES DE GARMO. *Principles of Secondary Education.* Volume I. I. *Basic Ideals.* II. *The Studies.* New and enlarged edition. New York: The Macmillan Company, 1913. Pp. xiii, 338. $1.25.

Much pressure has recently been brought to bear upon the high school to produce a fundamental alteration of its purposes in the direction of vocational ends. In order to furnish a perspective for the whole situation the author has prefaced this new edition of "The Studies" with six chapters upon "Basic Ideals for Educational Progress." These chapters consider education from the standpoints of prosperity, health, culture, vocational preparation, eugenics and euthenics, and the relations between individuals and social groups. The remainder of the book, on the function and relative educational worth of the secondary studies, has undergone little change.

JOHN DEWEY. *Interest and Effort in Education.* Riverside Educational Monographs. Boston: Houghton Mifflin Company, 1913. Pp. x, 102. $0.60.

"The active acceptance by teachers of this statement of the functions of interest and effort in education would bring about a complete transformation of classroom methods, and its appreciation by the patrons of the school would greatly modify current criticism of the various programs of educational reform."

BENJAMIN DUMVILLE. *Child Mind. An Introduction to Psychology for Teachers.* London: University Tutorial Press, 1913. Pp. vii, 214. 2s. 6d.

The question, "What type of psychology does the teacher need in preparation for his work," is still far from a satisfactory answer. The present little book is intended as an outline for use by students in training colleges and by candidates preparing for such professional examinations as the Board of Education Teacher's Certificate. The author is evidently familiar with recent work in experimental education, but a casual inspection of the book reinforces one's conviction that psychology for teachers is still under the domination of texts written from an entirely different point of view. Why can we not have a psychology for teachers that goes directly at a psychological analysis of the teacher's task and the mental activities involved in its performance, rather than wanders on in the traditional ruts of sensation, perception, association, imagery, ideation, instinct and habit formation? The book under consideration fulfils its mission of offering preparation for certain examinations, and does it with a greater regard for the teacher's problems than most of the books in the field, but it is still far from what the teacher needs.

CHARLES W. ELIOT. *The Tendency to the Concrete and Practical in Modern Education.* Riverside Educational Monographs. Boston: Houghton Mifflin Co., 1913. Pp. iv, 57. $0.35.

There has been no more vigorous and powerful advocate of the practical in education than ex-president Eliot, and his recent trip around the world and his personal study of conditions in the Orient have intensified his convictions as to the value of such education for national supremacy. Undue emphasis upon words and upon memoriter study leads to serious consequences for the intellectual life of the nation, and in our education we should ever strive to provide first hand contact with things.

FRANCIS J. FINN. *The Fairy of the Snows.* New York: Benziger Brothers, 1913. Pp. 221. $0.85.

A juvenile story in which certain phases of Roman Catholic doctrine are presented.

FRITZ GIESE. *Das freie literarische Schaffen bei Kindern und Jugendlichen.* Beihefte zur Zeitschrift für angewandte Psychologie, No. 7. Zwei Teile. I. Abhandlung. II. Proben. Leipzig: J. A. Barth, 1914. Pp. 220 + 242. Mark 14.

An elaborate statistical study of the free literary activities of children. Three groups of material were considered: First, compositions that were written for and handed in as school exercises. Second, the author gained access to a large collection of children's stories written for a prize competition initiated by one of the Berlin newspapers. Third, such youthful prose and poetry as the author could find in a search through children's magazines, early publications, and the like. Contrary to expectation boys write more poetry than girls. Boys are more original and creative, more serious and dignified, girls hold more closely to the traditional, and affect a more cheerful, playful style. In general children have a juster critical attitude toward their own work than is usually assumed.

FRANK PIERREPONT GRAVES. *A History of Education in Modern Times.* New York: The Macmillan Company, 1913. Pp. xv, 410. $1.10.

The third in a series of three books designed to cover the whole field of European and American education. Special attention is paid to the history of education in the United States, and three chapters are devoted to this subject, in addition to the many references to American conditions in other chapters. Such recent tendencies in the educational world as the Montessori methods, the derivation of educational scales of measurement, and the efforts at vocational training and guidance receive due consideration.

JOSEPH K. HART. *Educational Resources of Village and Rural Communities.* New York: The Macmillan Company, 1913. Pp. x, 277. $1.00.

A series of sixteen chapters on various aspects of life in rural communities. Among the resources treated are the physical and economic, the human resources, health, local history, political life, outdoor beautification, home life, recreation, moral and social deficiencies, the religious and intellectual life, and the relation of the community to the administrative aspects of education. Each chapter is followed by a good working bibliography of the subject.

C. H. HOLZWARTH. *Gruss aus Deutschland.* New York: D. C. Heath & Co., 1913. Pp. vi, 190.

This is a distinct novelty in the way of a beginner's book in German. The author, impressed by the poor pedagogy of plunging the beginner into a book demanding a vocabularly of 2500 to 3500 words, has constructed a story of a trip through Germany involving the use of only 750 stem words. The book is splendidly illustrated, and the story cannot fail to interest the most apathetic pupil.

W. FRANKLIN JONES. *Concrete Investigation of the Material of English Spelling.* Vermillion, S. Dak.: University of South Dakota, 1913. Pp. 27.

The author started with the problem, "What words, grade for grade, do children use in their own free written speech, and what words, therefore, do they need to know how to spell?" Over 75,000 themes from 1050 pupils ranging from the second to the eighth grades were studied for their vocabularies. While there were approximately 15,000,000 words in all, the total number of different words was 4532. The monograph presents the lists of these words, with their distribution in the grades.

JOHN C. KIMBALL. *The Ethical Aspects of Evolution.* Boston: American Unitarian Association, 1913. Pp. 420. $1.25.

These delightful essays on the development of moral standards in society are founded upon a sound scientific basis, yet are written with a direct appeal to the layman. It is such reading material as this that should be introduced more liberally into our high school courses. The adolescent mind rejoices in the treatment of broad questions in a sweeping manner, and vastly greater results for the stimulation of thought could be secured by the perusal of such interesting essays than by the grind on the so-called classics of literature.

EDITH B. ORDWAY. *Synonyms and Antonyms.* New York: Sully and Kleinteich, 1913. Pp. ix, 292. $1.00 net.

"A genuine dictionary of words in ordinary use, with all of the important words of like or similar meaning, followed by the chief words of opposite meaning."

CHARLES A. PROSSER AND W. I. HAMILTON. *The Teacher and Old Age.* Riverside Educational Monographs. Boston: Houghton Mifflin Company, 1913. Pp. xi, 140. $0.60.

The authors survey the existing pension and annuity laws for teachers in European countries and in the various localities of this country, analyze the principle of annuities as a form of social insurance, set forth various methods of administering retirement allowances, present a model retirement law, and discuss the means of securing legislation on the subject.

GERTRUDE RAND. *The Factors that Influence the Sensitivity of the Retina to Color.* Reprinted from Psychological Monographs, Princeton, N. J., March, 1913. Pp. 166.

The first eighty pages of this monograph are devoted to a historical and critical survey of the work that has already been done on color vision. In the remainder we have an account of an experimental investigation of the factors conditioning sensitivity to color: (1) Brightness of the stimulus, (2) brightness of the field surrounding the stimulus, (3) brightness of the pre-exposure, and (4) the general illumination of the retina.

ELEANOR ROWLAND. *The Significance of Art.* Boston: Houghton Mifflin Company, 1913. Pp. xiii, 189. $1.00 net.

A group of five essays on sculpture, the minor arts, painting, music, and art and nature. The author raises the question "What is art in these various forms?" and then endeavors to find the answer by an analysis of art experiences. In each case the analysis is gracefully and smoothly carried out.

NETTIE ALICE SAWYER. *Five Messages to Teachers of Primary Reading.* Chicago: Rand, McNally & Co., 1913. Pp. 219.

The author of this book seems to be entirely free from the taint of contact with any scientific studies of reading, but presents a large number of practical devices which would stimulate the wide-awake teacher of reading to reflection and perchance to experimentation. The term "message" has no further significance here than "part or division of the book."